Chapter Three

An Enquiry into the Causes of Moonlighting

3.1. Introduction

One of the major objectives of this study is to investigate reasons behind moonlighting. The phenomenon of moonlighting is prevalent in almost all labor markets. The motivations behind moonlighting may vary across occupations and across nations. Researchers in this field are employing their efforts to unearth the reasons underlying decision to moonlight across occupations and nations. This chapter deals with the analysis of various motive forces behind moonlighting decision of the workers. In Chapter One, section – 1.7, in the context of writing the basic objectives of the study/research, we pointed out that our task is three important issues related to the causes of moonlighting and to be considered in this chapter. The first task is to assess the degree of effectiveness of some economic, sociological and demographic factors in the moonlighting decision of the heads of households residing in Hasnabad Block of the state of West Bengal. Our second task is to intend a Political Business Cycle (PBC) model which examines whether political decisions and their implementations prior to the imminent election by the incumbent party in power have any responsibility to control the rate of moonlighting. Our final task is to test how the national time series data of moonlighting fits with the proposed Political Business Cycle (PBC) theory. To execute the final task, we select the Czech Republic as the reference of study. Therefore we need to organize this chapter as follows.

In section 3.2 we present a list of the already identified causes behind moonlighting decision of workers. The microeconomic theory of labor – leisure choice to explain the ‘hours constraint’ and ‘heterogeneous jobs’ motives of moonlighting is presented in section 3.3. Section 3.4 analyses empirically the soundness of the hours constraint, along with some other economic and socio-demographic factors, behind moonlighting decision of the heads of households in the Hasnabad Block of West Bengal. In section 3.5, the Political Business Cycle theory of moonlighting is proposed. Section 3.6 deals with the empirical verification of the proposed
Political Business Cycle theory of moonlighting in the Czech Republic. Finally section 3.7 concludes this chapter.

3.2. Why People Moonlight?
The decision to participate in the moonlighting activities depends on diverse economic and non-economic (sociological, demographic, political) reasons. Various studies have been identified several factors that force a worker to decide for moonlighting. We can categorize those factors into different groups. Following are the list of factors that may force a worker to decide for moonlighting.

3.2.1. Economic Reasons of Moonlighting
Researchers have identified several economic factors that influence the workers’ decision to moonlight. The identification of the economic factors influencing moonlighting is generally based on the microeconomic theory of labor – leisure choices. The standard microeconomic theory of labor – leisure choice envisages how many hours a worker decides to work at the existing wage rate. In this theory, workers are assumed to have an endowment of time and they choose to allocate this endowment among various jobs to maximise utility. Following are the list of economic factors affecting moonlighting decision of an individual.

- The Hours Constraint
With a given hourly wage rate, if a worker cannot supply as much hours of work in the primary job as he/she desires in his/her utility maximizing level, the utility maximizing worker will tend to invest ‘unutilized’ hours into another (secondary) job/jobs. The employers’ inability to purchase all utility maximizing hours of work in the primary job with a fixed wage rate is termed as ‘hours constraint’. An hours constrained worker will choose to moonlight only if the wage offered in the moonlighting job lie between the reservation wage and the wage rate of primary job. The hours constrained moonlighter experience a convex kink in his/her budget constraint. The studies of Guthrie (1969), Shisko and Rostker (1976), O’Connell (1979) and Krishnan (1990) support the ‘hours constraint’ motivation of moonlighting.
• **The Heterogeneous Job Motive**

In addition to the ‘hours constraint’, Lilja (1991) and Conway and Kimmell (1998) argued that moonlighting is a result of desire for employment in heterogeneous jobs. An individual may decide to moonlight if he/she can derive different sources of satisfaction from the primary and the secondary jobs. For jobs with imperfect labor substitutability, the wages paid and leisure lost in the moonlighting job is not directly comparable with those of primary job and individuals could choose to experience multiple heterogeneous jobs by equating their marginal utilities. The studies of Kimmel and Conway (2001) for the U.S. and Boheim and Taylor (2004) for Great Britain confirmed the evidence of multiple motives regarding decision to moonlight, with the hours constraint motive being the most common one. They argued that the presence of hours constraint to explain moonlighting over time is unsatisfactory. Job heterogeneity is, therefore, more consistent explanation of moonlighting over time.

• **The Liquidity Constraint**

If a worker enjoys low current income relative to their educational attainment, he/she will fail to manage liquid funds to meet expenses (current spending needs) to continue the average life style like other members in the society; the individual become liquidity constrained. Abdukadir (1992) found existence of this motive of moonlighting in Florida.

• **The Negative Financial Shock**

If a worker faces negative financial shock, the labor supply preferences of the worker tend to be changed. Due to the negative financial shock, optimal labor supply decision of the worker increases. If the worker cannot supply increased work hour in the primary job as he/she desires at his/her utility maximizing level, the worker may decide to moonlight. Boheim and Taylor (2004) found evidence of the negative financial shock in shaping moonlighting decision of the British people.

• **Hedge against future unemployment / job insecurity**

The fears to lose their primary job may compel the workers to search for additional secondary jobs. Workers working in the primary jobs with high risk of termination may
moonlight to use second jobs as insurance against the risk of first job loss. Bell, Hart and Wright (1997) found modest evidence of this motive in the U.K.

- **Overtime pay regulation in the primary job**
  Regulations restricting or limiting overtime pay in the primary job may induce a worker to decide for moonlighting. Friesen (2001) found some evidence of this motive of moonlighting.

- **Portfolio selection of different jobs**
  By focusing on the link between moonlighting and job mobility, Paxson and Sicherman (1996) argued that moonlighting is nothing but the portfolio selection of different jobs. According to Paxson and Sicherman (1996), moonlighting is a mechanism by which individuals adjust their hours of work. Two bases about the adjustment mechanism of hours of work have been identified by them. First, if the two jobs complement each other, the workers ‘portfolio diversify’ the available hours of work between jobs where the primary job supplies the primary source of income and the secondary job provides training, contacts, and prestige. Second, moonlighting is the portfolio selection of different jobs, where primary job of an individual provides him/her low but steady income while additional (secondary) jobs provide high income on average but are more variable in nature.

- **Low or insufficient income from the primary job**
  Low or insufficient wages in the primary job encourages moonlighting. To maintain daily livelihood expenses, the worker with low wage rate in the prime job is more likely to sell work hour in additional jobs. Kimmel and Conway (2001) found some evidence of this motive. Schaffner and Cooper (1991) argued that declining marginal return to labor on the prime job may induce a self-employed person to decide for moonlighting.

3.2.2. **Sociological Factors of Moonlighting**
The economic causes behind moonlighting decision are based on the microeconomic theories of labor – leisure choice which considers the individual as a worker and emphasise on the pecuniary
(monetary) determinants of choice. But in reality there are various relevant paradigms for explaining moonlighting behaviour that do not give primacy to financial motivations. Following are the list of sociological factors affecting moonlighting decision of an individual.

- **Emotional attachment to the secondary job**
  Lundberg (1995) argued that in addition to a prime job, a worker may be motivated to spend some hours of work in some additional (moonlighting) jobs due to some emotional attachment (net non-pecuniary benefit) to that job. If a moonlighter has some emotional or other attachment to a specific secondary job, he would decline to accept offers of employment in higher paying jobs. If a moonlighter suffer with a falling earnings in the existing job or he/she is offered another better paid but less preferred job, he/she is unlikely to give up his/her secondary job. In other words, a moonlighter will continue employment in a second job with low income if net non-pecuniary benefit is positive and leave the job if net non-pecuniary benefit is negative.

- **Low socio-economic status**
  Ferman, Henry and Hoyman (1987) argued that decision to moonlight is primarily due to individuals' feelings about their low socio-economic status and moonlighting may act as a safety net for the poor. According to Wilensky (1963), moonlighting is a result of relative deprivation of workers in the society.

- **Relative Aspiration Hypothesis**
  As an alternative to the views of relative deprivation, Jamal (1986) provided another explanation of moonlighting in contrast to the views of Wilensky (1963), which states that moonlighters are special people with more energy and they are motivated to moonlight for higher aspirations.

In addition to those economic and sociological factors affecting moonlighting decision, many studies have identified several other factors such as region, age, educational status, occupational status etc. Among several factors affecting moonlighting decision, the most common factor considered by various studies is the hours constraint in the prime job. The hours constraint
explanation can be analyzed with the help of standard microeconomic theory of labor – leisure choice.

3.3. Microeconomic Theory of Moonlighting

The most influential theoretical study in the field of economics of moonlighting using microeconomic theory of labor-leisure choice was done by Shishko and Rostker (1976) to provide ‘hours-constraint’ explanation of moonlighting. Conway and Kimmell (1992) studied the ‘heterogeneous-jobs’ motive of moonlighting in addition to the hours constraint motive.

3.3.1. The Theory of Hours Constraint

Let us consider a representative individual. He/she wishes to supply $h_1$ labor hour on the primary job. Let $w_1$ is the wage rate per hour in the primary job, $l$ stands for leisure and $A$ stands for non-labor income, $c$ stands for consumption and $T$ denotes total time available. The utility function of the individual is,

$$ U = U(c, l) \text{ such that } \frac{\partial U}{\partial c} \cdot \frac{\partial U}{\partial l} > 0 $$

(3.3.1)

The utility function (3.3.1) is continuous and convex in $c$ and $l$. Maximum time available to a worker is denoted as $T$ (twenty four hours per day). Therefore the time constraint of the worker is

$$ T = h_1 + l $$

(3.3.2)

The budget (or income) constraint faced by the worker, if price of consumption bundle is normalized to unity and all income is consumed (no savings), can be represented by the following equation.

$$ c = w_1 h_1 + A $$

(3.3.3)

We assume that working on primary job provides no disutility to the representative worker due to foregone leisure. Using (3.3.2) into (3.3.3) we get the (converted) budget constraint as

$$ c = w_1 (T - l) + A $$

(3.3.4)

The utility maximization problem of the representative individual can be represented by (3.3.5).
\[
\begin{align*}
\text{Max } U &= U(c,l) \\
\text{s.t. } c &= w_1(T-l) + A \\
h_1 &> 0, l > 0
\end{align*}
\] (3.3.5)

The Lagrangian of the maximization problem (3.3.5) is
\[
L = U(c,l) + \lambda \left( A + w_1(T-l) - c \right)
\] (3.3.6)

where \( \lambda \) is the Lagrangian multiplier.

First order condition for maximization requires
\[
\frac{\partial L}{\partial h_1} = \frac{\partial U}{\partial c} w_i - \lambda w_i = 0
\]
\[
\Rightarrow \frac{\partial U}{\partial c} - \lambda = 0
\] (3.3.7)

And
\[
\frac{\partial L}{\partial l} = \frac{\partial U}{\partial l} - \lambda w_i = 0
\] (3.3.8)

The first order conditions (3.3.7) and (3.3.8) ensures
\[
w_i = \frac{\partial U}{\partial l} \bigg/ \frac{\partial U}{\partial c}
\] (3.3.9)

The first order condition (3.3.9) implies that the representative worker chooses the optimal hours of work \( (h_1^*) \) where marginal value of leisure in terms of foregone consumption (or income) is equated with the wage rate. The assumption of convex and continuous utility function ensures the validity of sufficient (second order) condition for utility maximization.

The solution is illustrated graphically in Figure 3.3.1 where the line XY represents the budget constraint \( c = w_1(T-l) + A \), and the non-labor income is \( A = TY \). The slope of the budget line XY is \(-w_1\). The worker attains maximum level of utility at point E where the budget line is tangent to the indifference curve \( U_3 \). At this equilibrium point, the worker wishes to supply \( h_1^* = MT \) hours to the primary job.

Now let us assume a situation where the representative worker cannot supply the optimal hours of work \( (h_1^*) \) due to labor market constraints. Instead of \( h_1^* \), let the worker is constrained to
supply only $\bar{h}_1$ (constant) hours in the primary job such that $h^*_1 > \bar{h}_1$. Then the worker is compelled to stay at point G in Figure 3.3.1. The worker is unable to supply equilibrium hours of work as he desire in his utility maximizing level. Therefore the worker is influenced to moonlight. The decision to moonlight then depends on the wage offered in the second job.

Let the wage offered in the second job is $w_2$. The reservation utility is $U_1$ which passes through the point G. The reservation wage of the moonlighting job ($w^*_2$) is the absolute slope of PQ, which is tangent to the indifference curve $U_1$ (representing reservation utility) passing through the point G. If the wage offered in the moonlighting job exceeds the reservation wage, i.e., $w_2 \geq w^*_2$, the constrained worker will decide to moonlight.

If the hours constrained worker faces $w_2 \geq w^*_2$, he chooses to moonlight by supplying $h_2$ hours in the moonlighting job. The time constraint faced by a moonlighting individual who is hours constrained in his primary job is

$$T - \bar{h}_1 = h_2 + l \quad (3.3.10)$$

And the budget constraint faced by the hours constrained moonlighting individual is

$$c = w_2 h_2 + \left( w_1 \bar{h}_1 + A \right) \quad (3.3.11)$$

Combining (3.3.10) and (3.3.11), we get the transformed budget constraint as

$$c = w_2 \left( T - \bar{h}_1 - l \right) + \left( w_1 \bar{h}_1 + A \right) \quad (3.3.12)$$

The utility maximization problem of the hours constrained moonlighting individual is given by (3.3.13) as

$$\begin{array}{c}
\text{Max } U = U(c, l) \\
\text{S.t. } \left\{ c = w_2 \left( T - \bar{h}_1 - l \right) + \left( w_1 \bar{h}_1 + A \right) \\
h_2 > 0, l > 0 \right\} \\
\end{array} \quad (3.3.13)$$

The relevant Lagrangian of the maximization problem (3.3.13), is

$$\bar{L} = U(c, l) + \mu \left( w_2 \left( T - \bar{h}_1 - l \right) + \left( w_1 \bar{h}_1 + A \right) - c \right) \quad (3.3.14)$$

where $\mu$ is the Lagrangian multiplier.

The solution of (3.3.13) requires the following first order conditions
The combination of first order conditions (3.3.15) and (3.3.16) ensures

\[ \frac{\partial L}{\partial h_2} = \frac{\partial U}{\partial c} w_2 - \mu w_2 = 0 \]  

(3.3.15)

And \[ \frac{\partial L}{\partial l} = \frac{\partial U}{\partial l} - \mu w_2 = 0 \]  

(3.3.16)

The first order condition (3.3.17) implies that the representative worker chooses to supply work hour \( h_2^* \) at the secondary (moonlighting) job in his/her utility maximizing level where the marginal value of leisure in terms of foregone consumption (or income) is equated with the wage rate. The assumption of convex and continuous utility function ensures the validity of sufficient (second order) condition for utility maximization.

The first order condition (3.3.17) implies that the representative worker chooses to supply work hour \( h_2^* \) at the secondary (moonlighting) job in his/her utility maximizing level where the marginal value of leisure in terms of foregone consumption (or income) is equated with the wage rate. The assumption of convex and continuous utility function ensures the validity of sufficient (second order) condition for utility maximization.

Figure - 3.3.1: Equilibrium of a Constrained Moonlighter
The solution of problem (3.3.13) is illustrated in Figure 3.3.1 where the line RD represents the new budget constraint \( c = w_2(T - h_l - h) + (w_1 h_l + A) \). The slope of the budget line RD is \(-w_2\).

The worker attains maximum level of utility at point F where the budget line RD is tangent to the indifference curve \( U_2 \). At this equilibrium point, the worker wishes to supply \( h_2^* = P N \) hours to the moonlighting job. By moonlighting the worker gets a higher utility at point F and decides to supply \( h_2^* \) labor hour in the second job. Moonlighting is beneficial to a constrained worker if and only if the wage offered in the moonlighting job is lower than the wage rate in primary job \( (w_2 \leq w_1) \). If \( w_2 > w_1 \), a constrained worker will spend all work hour in the secondary (moonlighting) job.

The solution of (3.3.13) gives the testable moonlighting labor supply equation

\[
h_2^* = f(w_1, w_2, h_l, A) \tag{3.3.18}
\]

As per analysis of Shishko and Rostker (1976), if leisure is a normal good, the expected signs of partial derivatives are \( \frac{\partial h_2^*}{\partial w_1} < 0, \frac{\partial h_2^*}{\partial A} < 0, \frac{\partial h_2^*}{\partial h_l} < 0 \) with some ambiguity in the sign of \( \frac{\partial h_2^*}{\partial w_2} \).

Assuming all workers are constrained on their primary jobs, Shishko and Rostker (1976), O’Connell (1979), Krishnan (1990) estimated Tobit or Probit moonlighting functions similar to that written in (3.3.18).

### 3.3.2. Job Heterogeneity

Workers may also decide to moonlight even though they do not face any hours constraint on their primary job. For example, the ‘hours-constraint’ explanation of moonlighting cannot explain why a musician/artist opts for employment in a regular non-music/non-art job in the usual working hour and music/artistic performance in time other than normal working hour (Casacuberta and Gandelman (2006)). Similarly, this explanation of moonlighting cannot justify why a well paid professor/teacher moonlights through consultation/private tuition (Conway and Kimmell (1998), Heineck (2003), Böheim and Taylor (2004)). An alternative to the ‘hours-constraint’ explanation of moonlighting is the existence of job heterogeneity. Individuals may desire to work in a moonlighting job for reasons that are not connected to the hours of work or
earnings in primary job. For jobs with imperfect labor substitutability, the wage paid and leisure lost are not directly comparable; and job heterogeneity as a logical explanation of moonlighting decision comes into existence. The non-substitutability of hours of labor supplied to different jobs may appear due to various reasons which include engaging in activities of interest, gaining some job satisfaction not received from the prime job, emotional attachment to the secondary job etc.

Let us consider a representative individual who desires to moonlight for employment in heterogeneous jobs, not for any existence of constraint in primary job. Since jobs are heterogeneous, the number of hours worked in the first job \( h_1 \), the number of hours worked in the secondary job \( h_2 \), and the hours of leisure \( l \), enter the utility function separately (Conway and Kimmel (1998)). Then the utility function of the representative individual who desires to moonlight for employment in heterogeneous jobs can be represented as

\[
U = U(h_1, h_2, l, c) \quad \text{such that} \quad \frac{\partial U}{\partial c}, \frac{\partial U}{\partial l} > 0 \quad \text{and} \quad \frac{\partial U}{\partial h_1}, \frac{\partial U}{\partial h_2} \geq 0 \quad (3.3.19)
\]

The utility function (3.3.19) is continuous and convex in \( h_1, h_2, l \) and \( c \). The representative individual faces the time constraint

\[
T = h_1 + h_2 + l \quad (3.3.20)
\]

And the budget constraint faced by the representative individual is

\[
c = w_1 h_1 + w_2 h_2 + A \quad (3.3.21)
\]

Using (3.3.20) and (3.3.21) into the utility function (3.3.19) we get

\[
U = U(h_1, h_2, (T - h_1 - h_2), w_1 h_1 + w_2 h_2 + A) \quad (3.3.22)
\]

Therefore the utility maximization problem of the representative individual reduces to

\[
\max_{h_1, h_2} U(h_1, h_2, (T - h_1 - h_2), w_1 h_1 + w_2 h_2 + A) \quad (3.3.23)
\]

The first order conditions for solution of (3.3.23) require

\[
\frac{\partial U}{\partial h_1} + \frac{\partial U}{\partial c} w_1 - \frac{\partial U}{\partial l} = 0
\]

\[
\Rightarrow -w_1 = \left( \frac{\partial U}{\partial h_1} - \frac{\partial U}{\partial l} \right) \left/ \frac{\partial U}{\partial c} \right. \quad (3.3.24)
\]
\[
\frac{\partial U}{\partial h_2} + \frac{\partial U}{\partial c} w_2 - \frac{\partial U}{\partial l} = 0
\]

\[
\Rightarrow -w_2 = \left( \frac{\partial U}{\partial h_2} - \frac{\partial U}{\partial l} \right) \left/ \frac{\partial U}{\partial c} \right. \tag{3.3.25}
\]

The numerator in (3.3.24), \( \left( \frac{\partial U}{\partial h_2} - \frac{\partial U}{\partial l} \right) \) is the marginal disutility from an extra hour of work in the primary job. Similarly the numerator in (3.3.25), \( \left( \frac{\partial U}{\partial h_2} - \frac{\partial U}{\partial l} \right) \) is the marginal disutility from an extra hour of work in the moonlighting job. The ratios \( \left( \frac{\partial U}{\partial h_i} - \frac{\partial U}{\partial l} \right) \left/ \frac{\partial U}{\partial c} \right. \) \( \forall i = 1,2 \) imply the disutility of working in the \( i \)th job. Therefore, the two equations (3.3.24) and (3.3.25) implies that the representative individual will continue to supply work hour into both primary and moonlighting job until the disutility of working in that job is equal to the negative wage of that job.

The equilibrium of a non-constrained moonlighter can be depicted graphically only for the case of a higher paying moonlighting job\(^a\). In Fig. 3.3.2., XY is the budget line of primary job and RD is the budget line of secondary (moonlighting) job. As is obvious from the figure, the wage rate of the moonlighting job \( (w_2, \text{the absolute slope of RD}) \) is higher than the wage rate of the primary job \( (w_1, \text{the absolute slope of XY}) \). Standard working time span in the primary job is HT, and the moonlighter chooses any amount \( h_1^* \in (0, HT) \) that solves problem (13.3.23). As the worker faces \( w_2 > w_1 \), he/she decides to supply labor hour in the moonlighting job if and only if he/she can reach at least the maximum attainable utility by working in the primary job \( (U_3) \). In Figure – 3.3.2, equilibrium is achieved at E and F for primary and moonlighting job respectively; where the worker chooses to work for \( h_1^* = MT \) hours in the primary job and \( h_2^* = MN \) in the secondary job in equilibrium.
A typical moonlighter solves (3.3.23) if jobs are heterogeneous. The solution of (3.3.23) can be obtained by solving (3.3.24) and (3.3.25), which gives two separate testable labor supply functions,

\[ h_i^* = f(w_i, w_j, A) \quad \forall i = 1, 2 \quad (3.3.26) \]

As per analysis of Conway and Kimmell (1998), if leisure is a normal good, the expected signs of partial derivatives are \( \frac{\partial h_i^*}{\partial A} < 0 \) and \( \frac{\partial h_i^*}{\partial w_j} < 0 \) \( \forall i \neq j \).

In order to distinguish between two types of moonlighters, Conway and Kimmel (2001) and Böheim and Taylor (2004) argued that constrained moonlighter will have on average a shorter tenure in the moonlighting job than the non-constrained moonlighter. This is so because that after facing hours constraint in the prime job, finding out another prime job with same or higher wage rate is beneficial to a worker than moonlighting through a low paid job\(^{iii}\). On the other hand, if moonlighting provides a worker with non-pecuniary benefits (moonlighting due to job...
heterogeneity), no such particular relationship between wages in the prime and the moonlighting job exists. In that case longer tenures in both jobs are expected.

3.4. The Determinants of Moonlighting in the Hasnabad Block of West Bengal

There are a lot of factors playing the influential role in shaping moonlighting decision of workers. Among all those factors, the working of hours constraint to influence workers to decide for getting employment in additional jobs is more common in almost all empirical studies. This section is entrusted to test empirically the validity of the hours constraint, along with some other socio-demographic factors behind moonlighting decision of the citizens belonging to the Hasnabad block of West Bengal.

Hasnabad Block is situated at the south east side of the North 24 Parganas District, on the western bank of Ichhamati River of the state of West Bengal. This block is not so economically advanced. Prime economic activity in this block is agriculture. After partition of British India, the migrated people from East Pakistan over floated to Hasnabad, raised the labor supply in productive activities and responded to lower the wage rate than the national average. Increased unemployment due to sudden increase in labor supply compelled the people of Hasnabad to be engaged in some petty, informal activities. This area was not so industrially developed to capture the pressure of population in industrial activities. Even after sixty four years of independence, this block is suffering from massive pressure of population. Therefore most of the people of Hasnabad cannot supply as much labor as they want at their utility maximizing level due to scarcity of jobs, become hours constrained. This justifies the choice of the Hasnabad Block to perform the empirical task to test the validity of the hours constraint in shaping moonlighting decision of individuals.

Table – 3.4.1 presents the area profile of Hasnabad Block. In 2011, a total of 177,521 people are residing in Hasnabad. A total number of 34959 households are residing in this block with average household size of five. Percentage of SC and ST population is moderate, 25 percent and 3 percent respectively. There are 948 females per 1000 males. Literacy rate is 63 percent. There is no urban area in this block and therefore urban population is nil. Among 37 percent total workers in the Hasnabad block, 30 percent are main workers and 7 percent are marginal workers.
### Table 3.4.1. Area Profile of Hasnabad Block of North 24 Parganas district, West Bengal in 2011

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Households</td>
<td>34,959</td>
</tr>
<tr>
<td>Average Household Size (per Household)</td>
<td>5</td>
</tr>
<tr>
<td>Population-Total</td>
<td>177,521</td>
</tr>
<tr>
<td>Proportion of Urban Population (%)</td>
<td>0</td>
</tr>
<tr>
<td>Population-Rural</td>
<td>177521</td>
</tr>
<tr>
<td>Sex Ratio</td>
<td>948</td>
</tr>
<tr>
<td>Population-Urban</td>
<td>0</td>
</tr>
<tr>
<td>Sex Ratio (0-6 Year)</td>
<td>944</td>
</tr>
<tr>
<td>Population (0-6 Years)</td>
<td>29,641</td>
</tr>
<tr>
<td>Sex Ratio (SC)</td>
<td>925</td>
</tr>
<tr>
<td>SC Population</td>
<td>45,043</td>
</tr>
<tr>
<td>Sex Ratio (ST)</td>
<td>951</td>
</tr>
<tr>
<td>ST Population</td>
<td>6,012</td>
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<tr>
<td>Proportion of SC (%)</td>
<td>25</td>
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<tr>
<td>Literates</td>
<td>93,828</td>
</tr>
<tr>
<td>Proportion of ST (%)</td>
<td>3</td>
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<tr>
<td>Illiterates</td>
<td>83,693</td>
</tr>
<tr>
<td>Literacy Rate (%)</td>
<td>63</td>
</tr>
<tr>
<td>Total Workers</td>
<td>65,765</td>
</tr>
<tr>
<td>Work Participation Rate (%)</td>
<td>37</td>
</tr>
<tr>
<td>Main Worker</td>
<td>53,713</td>
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<tr>
<td>% of Main Workers</td>
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<tr>
<td>Marginal Worker</td>
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<tr>
<td>% of Marginal Worker</td>
<td>7</td>
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<tr>
<td>Non Worker</td>
<td>111,756</td>
</tr>
<tr>
<td>% of non Workers</td>
<td>63</td>
</tr>
</tbody>
</table>


### 3.4.1. Econometric Model and Methodology

The decision to participate in the moonlighting activities depends on the economic factors such as wage rate of primary job, wage rate of moonlighting job, hours worked in the prime job (for hours constrained moonlighter) and net asset income, as analyzed in the section 3.3. The studies of Shisko and Rostker (1976), Boheim and Taylor (2004), Kimmel and Conway (2001), Allen (1998), Renna and Oaxaca (2006), Jamal and Crawford (2007), Heineck and Schwarze (2004), Foley (1997), Naderi (2000) etc. confirmed that in addition to the economic motives, socio-demographic factors such as family size, age, experience, level of education etc., which can induce a worker to decide for moonlighting. A major problem of estimating moonlighting labor supply function lies in the availability of appropriate data through direct method. Instead of estimating the moonlighting labor supply function we would like to estimate the effects of different economic and socio-demographic factors on the moonlighting decision of heads of households in Hasnabad Block of West Bengal.
From the theoretical analysis presented in the previous section, it is clear that hours worked in primary job and incomes earned from the primary job are the most important determinants of moonlighting decision. In addition to these factors, we have considered some demographic and sociological factors that may have influence on moonlighting decision. More specifically, we can write,

\[ \text{Decision to moonlight} = f (\text{Income of the worker, Hours worked in primary job, Demographic Characteristics, Sociological Characteristics, Random Disturbances}) \]

We have to estimate the above equation using the econometric technique of binary response dependent variables.

### 3.4.1.1. Analytical Framework of the Econometric Model

Let us consider a sample of \( n \) independently and identically distributed observations \( i = 1, 2, \ldots, n \) of the dependent dummy variable \( y_i \) and a \( k \) dimensional vector \( x_i' \) of explanatory (exogenous) variables affecting probability of moonlighting and a constant. Let us specify \( y_i \) as a binary (dichotomous) variable, equals with 1 if the \( i^{th} \) worker moonlights and 0 if the \( i^{th} \) worker does not moonlight. To detect factors affecting the probability of moonlighting, we consider the general linear model as

\[ y_i = x_i' \beta + u_i \]  

(3.4.1)

where \( \beta \) is the \( k \) dimensional column vector of parameters and \( u_i \) is the disturbance term associated with the \( i^{th} \) observation.

Let \( P_i \) stands for the conditional probability that a worker/individual moonlights. In such a case, our task is to measure \( P_i \), in terms of a binary response model, conditional on certain information set consists of exogenous economic and socio-demographic characteristics of the worker. From the definition of \( P_i \), we can write, \( P_i = \text{Prob} (y_i = 1) \), which is the probability that \( i^{th} \) worker decides to moonlight and \( 1 - P_i = \text{Prob} (y_i = 0) \) which is the probability that \( i^{th} \) worker decides not to moonlight.
The expected value of the dichotomous dependent variable \( y_i \) is the probability that it takes the value one \((P_i)\). This is so because that,

\[
E(y_i|x_i) = (1 - P_i)0 + 1P_i = P_i = x_i'\beta
\]  

(3.4.2)

Therefore the calculated value of \( y_i \) from the regression equation (3.4.1) may provide the estimated probability that \( i \)th individual decides to moonlight, given \( x_i \).

But we cannot use the linear model (3.4.1) for estimation of probability that a person moonlights, since it suffers from the following shortcomings. *First*, the left hand side of equation (3.4.1) is discrete while the right hand side is continuous. *Second*, the probability that an individual moonlights is uniquely determined. The probability of moonlighting \( P_i = x_i'\beta \) can lie outside the admissible range \((0,1)\). *Third*, for fixed values of the vector \( x_i \), the error term \( u_i \) is entitled only two values, \((1 - x_i'\beta)\) and \((-x_i'\beta)\). Thus the distribution of the error term is discrete. *Finally*, the error term is heteroscedastic. Turning to the error variance, we have

\[
\text{var}(u_i) = (1 - x_i'\beta)^2 P_i + (-x_i'\beta)^2 (1 - P_i)
\]

\[
\Rightarrow \text{var}(u_i) = (1 - x_i'\beta)^2 \beta x_i + (-x_i'\beta)^2 (1 - x_i'\beta)
\]

\[
\Rightarrow \text{var}(u_i) = x_i'\beta(1 - x_i'\beta)
\]

Variance of the error term depends on \( x_i \). Therefore, the error term is heteroscedastic.

Consequently, we need to look for other binary response models which are free from above problems. For this we have to consider Logit or Probit models as alternative to the linear probability model (3.4.1).

Let us assume that there exist an underlying latent variable \( y_i^* \) for which we can observe the dichotomous realization of \( y_i \). The unobservable latent variable \( y_i^* \) linearly depends on the vector of exogenous variable \( x_i \) in such a manner that

\[
y_i^* = x_i'\beta + u_i
\]  

(3.4.3)
where \( \beta \) is the \( k \) dimensional column vector of parameters and \( u_i \) is the disturbance term associated with the \( i^{th} \) observation. The \( i^{th} \) individual moonlights if the latent variable is positive and does not moonlight if the latent variable is non-positive (either zero or negative). That means,

\[
y_i = \begin{cases} 
1 & \text{if } y_i^* > 0 \\
0 & \text{if } y_i^* \leq 0 
\end{cases}
\]  
(3.4.4)

In equation (3.4.3), we assume that the individual observations are independent and identically distributed so that the explanatory variables are exogenous and the error term is normally distributed and homoscedastic,

\[ u_i | x_i \sim N(0, \sigma^2) \]

Since multiplication of \( y_i^* \) by any positive constant does not change \( y_i \), if we observe \( y_i \), we can estimate the \( \beta \) 's in (3.4.3) only up to a positive multiple. Hence, we can set \( \sigma^2 = 1 \) which fixes the scale of \( y_i^* \).

Now, from (3.4.3) and (3.4.4) we get

\[
P_i = \text{Prob} (y_i = 1) = \text{Prob} (y_i^* > 0) \\
\Rightarrow P_i = \text{Prob} (u_i > -x_i' \beta)
\]

We assume that the error term \( u_i \) has a cumulative distribution function of \( F(u_i) \) and \( f(u_i) \) is the probability density function of \( F(u_i) \). Therefore,

\[
\text{Prob}(u_i > -x_i' \beta) = 1 - F(-x_i' \beta) = F(x_i' \beta)
\]

We assume that the distribution of \( u_i \) is symmetric so that \( 1 - F(-x_i' \beta) = F(x_i' \beta) \). Therefore, we can write,

\[
P_i = F(x_i' \beta)
\]  
(3.4.5)

The specification of the cumulative distribution function \( F(x_i' \beta) \) depends on the assumption made about the error term \( u_i \). Depending on the cumulative distribution function \( F(x_i' \beta) \) we can form the probit and logit models.
The probit model assumes that the cumulative distribution function $F(x'_i \beta)$ follows the standard normal distribution function, i.e.,

$$P_i = F(x'_i \beta) = \Phi(x'_i \beta) = \int_{-\infty}^{x'_i \beta} \phi(t) dt = \int_{-\infty}^{x'_i \beta} \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2} t^2\right) dt$$

(3.4.6)

where $\Phi(x'_i \beta)$ is the cumulative density function and $\phi(t)$ is the probability density function of the standard normal distribution.

The probit model is the non-linear statistical model in the parameters. In this model the probability $P_i$ is related to the explanatory variables in such a manner that the probability always lie inside the admissible range (0,1).

The logit model assumes that the cumulative distribution function $F(x'_i \beta)$ takes the form of a logistic function, as

$$P_i = F(x'_i \beta) = \Lambda(x'_i \beta) = \frac{1}{1 + \exp(-x'_i \beta)} = \frac{\exp(x'_i \beta)}{1 + \exp(x'_i \beta)}$$

(3.4.7)

where $\Lambda(x'_i \beta)$ is the logistic cumulative distribution function. As $x'_i \beta$ ranges from $-\infty$ to $+\infty$, the probability $P_i$ ranges between 0 and 1 and the $P_i$ is nonlinearly related to $x'_i \beta$. Since

$$P_i = \frac{\exp(x'_i \beta)}{1 + \exp(x'_i \beta)}$$

we can write

$$1 - P_i = 1 - \frac{\exp(x'_i \beta)}{1 + \exp(x'_i \beta)} = \frac{1}{1 + \exp(x'_i \beta)}$$

(3.4.8)

Therefore, the ratio of (3.4.7) and (3.4.8) gives,

$$\frac{P_i}{1 - P_i} = \exp(x'_i \beta)$$

(3.4.9)

This is called the odds ratio in favour of decision to moonlight. Taking logarithm of (3.4.9) we get,

$$\ln\left(\frac{P_i}{1 - P_i}\right) = x'_i \beta$$

(3.4.10)
The logarithm of the odds ratio, \( \ln \left( \frac{P}{1-P} \right) \) is called the logit. The logit follows some important properties. First, as \( P \) moves from 0 to unity, the logit moves from \(-\infty\) to \(+\infty\). That means although the probabilities lie between 0 and 1, logit is unbounded. Second, although logit is linear in \( x_i \), but the probabilities are not. Third, logit become negative and increasingly large in magnitude as the odds ratio decreases from 1 to 0 and becomes increasingly large and positive as the odds ratio increases from 1 to infinity.

3.4.1.2. Interpreta of the Parameters

In the binary response models, the parameters in \( \beta \) cannot directly be interpreted as slope coefficients or marginal probabilities. This is so because that the coefficients in \( \beta \) cannot be interpreted as the partial derivatives of \( E(y_i|x_i) \). More meaningful marginal effects can be provided by the index function \( z_i = x_i^\prime \beta = \sum_{j=1}^{k} x_{ij} \beta_j \). Even then, the marginal effect is only identified if there is sufficient reason to set \( \sigma^2 \) at unity.

The marginal effects of change in \( x_{ik} \) on the expected value of the observed variable \( E(Y_i|x_i) \) are provided as follows.

**Probit:**
\[
\frac{\partial E(y_i|x_i)}{\partial x_{ik}} = \frac{\partial P(y_i = 1|x_i)}{\partial x_{ik}} = \phi(x_i^\prime \beta) \beta_k
\]

**Logit:**
\[
\frac{\partial E(y_i|x_i)}{\partial x_{ik}} = \frac{\partial P(y_i = 1|x_i)}{\partial x_{ik}} = \frac{\exp(x_i^\prime \beta)}{(1 + \exp(x_i^\prime \beta))^2} \beta_k
\]

Since the marginal effects depends on all characteristics of the \( x_{ik} \) of all observations \( i \), each individual has different marginal effects. To summarize the individual effects, we intend to
present the marginal effects evaluated at sample mean $\bar{x}_i$. That means, we consider the marginal probabilities as, for the index function $z_i = x'_i \beta = \sum_{j=1}^{k} x_{ij} \beta_j$, the vector of slopes

$$
slope_j(\bar{x}) = \frac{\partial F(z)}{\partial x_j} \bigg|_{z=\bar{x}}
$$

### 3.4.1.3. Estimation in the Binary Response Models

The most common way to estimate binary response model is the method of maximum likelihood. Since $y_i$ takes only two values, 0 and 1, the observed $y_i$ is the realization of a binomial process with probability $P_i = F(x'_i \beta)$. Given a sample of $n$ observations on individual choices $y_i$, the probability density function of the observable random variable $y_i$ is,

$$L(Y_i) = P_i^{y_i} (1 - P_i)^{1-y_i} \quad \text{(3.4.11)}$$

Assuming independence across observations, the joint probabilities of observing the $Y_i$ values is given by the likelihood function

$$L(y_1, y_2, \ldots, y_n) = \prod_{i=1}^{n} L(y_i) = \prod_{i=1}^{n} P_i^{y_i} (1 - P_i)^{1-y_i}$$

$$\Rightarrow L(y_1, y_2, \ldots, y_n) = \prod_{i=1}^{n} F(x'_i \beta)^{y_i} (1 - F(x'_i \beta))^{1-y_i} \quad \text{(3.4.12)}$$

where $P_i = F(x'_i \beta) = \Phi(x'_i \beta)$ in the Probit model and $P_i = F(x'_i \beta) = \Lambda(x'_i \beta) = \frac{\exp(x'_i \beta)}{1 + \exp(x'_i \beta)}$ in the logit model. The only $n$ sample values of $y_i$ and $x_i$ are known, parameters in $\beta$ are unknown. Therefore to get the maximum likelihood estimator, we have to choose the values of $\beta$ in such a manner that the probability of obtaining the sample is maximum. The corresponding log likelihood function is, therefore,

$$\ln L(y_1, y_2, \ldots, y_n) = \sum_{i=1}^{n} \left( y_i \ln F(x'_i \beta) + (1 - y_i) \ln(1 - F(x'_i \beta)) \right) \quad \text{(3.4.13)}$$

The maximum likelihood estimators of $\beta$ can be obtained by maximizing (3.4.13), which require the first order conditions.
\[
\frac{\partial \ln L}{\partial \beta} = \sum_{i=1}^{n} \left[ y_i \frac{f(x'_i \beta)}{F(x'_i \beta)} + (1 - y_i) \frac{-f(x'_i \beta)}{1 - F(x'_i \beta)} \right] x'_i = 0 \tag{3.4.14}
\]

and the second order condition that the matrix \( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} \) will be negative definite. In (3.4.14) \( f(x'_i \beta) = \frac{\partial F(x'_i \beta)}{\partial (x'_i \beta)} \) is the probability density function.

We can simplify equation (3.4.13) for logit model as follows.

\[
\ln L(y_1, y_2, \ldots, y_n) = \sum_{i=1}^{n} \left( \ln F(x'_i \beta) - \ln(1 - F(x'_i \beta)) \right) y_i + \sum_{i=1}^{n} \ln(1 - F(x'_i \beta))
\]

\[
\Rightarrow \ln L(y_1, y_2, \ldots, y_n) = \sum_{i=1}^{n} \left( \ln \frac{F(x'_i \beta)}{(1 - F(x'_i \beta))} \right) y_i + \sum_{i=1}^{n} \ln(1 - F(x'_i \beta))
\]

\[
\Rightarrow \ln L(y_1, y_2, \ldots, y_n) = \sum_{i=1}^{n} \left( y_i \ln \frac{F(x'_i \beta)}{(1 - F(x'_i \beta))} + \ln(1 - F(x'_i \beta)) \right)
\]

\[
\Rightarrow \ln L(y_1, y_2, \ldots, y_n) = \sum_{i=1}^{n} \left( y_i x'_i \beta - \ln(1 + \exp(x'_i \beta)) \right)
\]

\[
\left[ \text{since } \frac{F(x'_i \beta)}{(1 - F(x'_i \beta))} = \exp(x'_i \beta) \text{ and } (1 - F(x'_i \beta)) = \frac{1}{1 + \exp(x'_i \beta)} \right]
\]

\[
\Rightarrow \ln L(y_1, y_2, \ldots, y_n) = \sum_{i=1}^{n} y_i x'_i \beta - \sum_{i=1}^{n} \ln(1 + \exp(x'_i \beta)) \tag{3.4.15}
\]

The maximum likelihood estimators of \( \beta \) in the logit model can be obtained by maximizing (3.4.15). The first order conditions for maximization of (3.4.14) requires that \( \frac{\partial \ln L}{\partial \beta} = 0 \). Now,

\[
\frac{\partial \ln L}{\partial \beta} = \frac{\partial}{\partial \beta} \left[ \sum_{i=1}^{n} y_i x'_i \beta - \sum_{i=1}^{n} \ln(1 + \exp(x'_i \beta)) \right] = 0
\]

\[
\Rightarrow \sum_{i=1}^{n} y_i x_i - \sum_{i=1}^{n} (1 + \exp(x'_i \beta))^{-1} \exp(x'_i \beta) x_i = 0
\]

\[
\Rightarrow \sum_{i=1}^{n} \left( y_i - \frac{\exp(x'_i \beta)}{1 + \exp(x'_i \beta)} \right) x_i = 0 \tag{3.4.16}
\]
From the specification of logit, as defined in (3.4.7), we have \( F(x'_i\beta) = \frac{\exp(x'_i\beta)}{1+\exp(x'_i\beta)} \). Therefore, (3.4.16) reduces to

\[
\sum_{i=1}^{n} (y_i - F(x'_i\beta))x_i = 0
\]

\[
\Rightarrow \sum_{i=1}^{n} y_i x_i = \sum_{i=1}^{n} F(x'_i\beta)x_i \tag{3.4.17}
\]

The maximum likelihood estimators of \( \beta \) in the logit model must satisfy the condition (3.4.17).

The second order condition requires that the matrix \( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} = -\sum_{i=1}^{n} x_i F(x'_i\beta)(1 - F(x'_i\beta))x'_i \) is negative definite.

There is no analytical solution of (3.4.17). Therefore to solve (3.4.17) numerical optimization methods are used. The most commonly used approach to the numerical solution of likelihood equations is the use of Newton-Raphson Method. Since the second derivatives \( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} \) do not involve the random variable \( y_i \) in the logit model, the Newton’s method is also the method of scoring. The negative definiteness property of \( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} \) ensures the global concavity of log likelihood. Therefore, after some iteration, the Newton-Raphson Method will usually converge to the maximum of log likelihood.

Let the maximum likelihood estimator of \( \beta \) is \( b \). The goal of the Newton-Raphson algorithm is to find out a root \( b \) of the equation \( \frac{\partial \ln L}{\partial \beta} = 0 \). We choose an initial value \( b_0 \) and consider the mapping of \( \beta \) onto a tangent plane,

\[
\delta(\beta): \beta \rightarrow d = \frac{\partial \ln L}{\partial \beta}
\]
The initial value $b_0$ is chosen on the basis of estimation of the linear probability model (3.4.1).

Let us use the first order Taylor expansion around $b_0$ as $d = \frac{\partial \ln L}{\partial b_0} + \frac{\partial^2 \ln L}{\partial b_0 \partial b'_0} (\beta - b_0) = 0$. This constitutes a linear approximation to the original map. Therefore, we can proceed to the desired solution as $d = \frac{\partial \ln L}{\partial b_0} + \frac{\partial^2 \ln L}{\partial b_0 \partial b'_0} (b_1 - b_0) = 0$ where $b_1 = b_0 - \frac{\partial \ln L}{\partial b_0} \left( \frac{\partial^2 \ln L}{\partial b_0 \partial b'_0} \right)^{-1}$ is the first estimate of $\beta$. Taking the value of $b_1$ as the starting point of the next iteration, we get

$b_2 = b_1 - \frac{\partial \ln L}{\partial b_1} \left( \frac{\partial^2 \ln L}{\partial b_1 \partial b'_1} \right)^{-1}$. For $h$ steps of approximation, the algorithm yields the recurrence formula

$$b_{h+1} = b_h - \frac{\partial \ln L}{\partial b_h} \left( \frac{\partial^2 \ln L}{\partial b_h \partial b'_h} \right)^{-1}$$

(3.4.18)

Now if $\{b_h\}$ converges to a limit $\{b\}$, a root of the $\frac{\partial \ln L}{\partial \beta} = 0$ can be expressed as the limit $\{b\}$ since, $b = \lim_{h \to \infty} b_{h+1} = b - \frac{\partial \ln L}{\partial b} \left( \frac{\partial^2 \ln L}{\partial b \partial b'} \right)^{-1} \Rightarrow \frac{\partial \ln L}{\partial b} = 0$.

The maximum likelihood estimates $b$ are consistent, asymptotically efficient and asymptotically normally distributed. A consistent estimate of the asymptotic variance covariance matrix of $b$ can be used as a basis for the hypothesis testing. Now we are in a position to conclude that maximum likelihood estimators $b$ exist for all sufficiently large $n$ and converges to the true value $\beta$. The maximum likelihood estimators $b$ are asymptotically normally distributed with mean $\beta$ and covariance matrix equal to the inverse of the Fisher information matrix

$$-E \left( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} \right)^{-1}.$$ Therefore,

$$b \sim N \left( \beta, -E \left( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} \right)^{-1} \right)$$

(3.4.19)
In other words, \(- \frac{\partial^2 \ln L}{\partial \beta \partial \beta'}\) converges in distribution to \(N(0, I)\).

### 3.4.1.4. Hypothesis Testing in the Binary Response Models

We would like to test the hypotheses that how the different sociological, demographic and economic characteristics affect the probability of moonlighting. Let the null and alternative hypotheses be

\[
H_0 : R\beta = r \quad H_1 : R\beta \neq r
\]

The equations (3.4.20) represent \( j \) independent hypotheses about the parameters \( \beta \). Now, since,

\[
b \sim N \left( \beta, - E \left( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} \right)^{-1} \right),
\]

we can specify the sampling distribution of \((Rb - r)\) as

\[
(Rb - r) \sim N \left( (R\beta - r), R \left[ - E \left( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} \right) \right]^{-1} R' \right)
\]

If the hypotheses (3.4.20) are true, then

\[
\lambda_w = \left( (R\beta - r) \left[ - E \left( \frac{\partial^2 \ln L}{\partial \beta \partial \beta'} \right) \right]^{-1} R' \right) (R\beta - r) \sim \chi^2_{(j)}
\]

where \( j \) is the number of independent restrictions being tested. This chi-square test statistic is known as the Wald test statistic. It will be large if the data do not support the null hypothesis. The null hypothesis will be rejected if \( \lambda_w \geq \chi^2_{(j)} \).

The Likelihood Ratio (LR) is also helpful to test the hypotheses. The LR test statistic is

\[
LR = -2 \left( \ln L_R - \ln L_u \right)
\]

where \( \ln L_u \) is the log likelihood of the unrestricted model and \( \ln L_R \) is the log likelihood of the restricted model. As in the maximum likelihood estimation we maximize the likelihood, the likelihood of the unrestricted model will be larger than the likelihood of restricted model. Thus the inside the bracket will be negative and LR will be positive. If LR is a large number i.e., if
there is a significant difference between $\ln L_R$ and $\ln L_u$, then the additional variables in the unrestricted model are jointly significant.

In linear regression model the squared multiple correlation $\left(R^2\right)$ is used to assess goodness of fit as it represents the proportion of variance in the criterion that is explained by the predictors. But, the standard $R^2$ measure of goodness of fit does not have the usual interpretation (i.e. it measures the percentage of variation in $y_i$ explained by the variation in $x_i$) in the binary choice models. An alternative measure of the goodness of fit is the McFadden’s pseudo $R^2$.

$$\text{McFadden’s pseudo } R^2 = 1 - \frac{\ln L_u}{\ln L_R}$$

### 3.4.2. Specification and Definition of Variables

This section deals with the specification and definition of variables to specify the actual models that are to be employed in the estimation process of the study of factors affecting decision to moonlight. We categorize the variables as follows.

- **Decision to Moonlight (MOON):**
  Decision to moonlight is a qualitative dichotomous dependent variable. If an individual supplies labor time at least one additional (moonlighting) job, the individual will be assigned the value 1, otherwise 0. This variable indicates the decision to participate in moonlighting activities by the heads of households in Hasnabad Block of the state of West Bengal.

  $$\text{MOON} = \begin{cases} 
  1, & \text{if the person is a moonlighter} \\
  0, & \text{otherwise}
\end{cases}$$

- **Level of Education:**
  Level of education bears a positive role to improve the quality of human capital. Improved labor quality acquired through higher education raises the wage rate demanded by workers which is expected to have some influence upon moonlighting decision. Therefore we consider the level of education as one of the important variable determining
moonlighting decision. In Model 1, we consider a continuous variable ‘years of schooling’ (YSCHOOL) to measure the effect of level of education on moonlighting decision. In Model 2, the level of education is grouped into five categories, individuals having education below the level of primary (forth standard), having education at the level of primary (PRM), secondary (SEC), higher secondary (HS) graduates and above (GRAD). Among them four groups are taken as explanatory variables to measure the effect on decision to moonlight of the heads of households residing in Hasnabad Block in the state of West Bengal. We assign ‘1’ if the individual belongs to any particular educational group.

\[
PRM = \begin{cases} 
1, & \text{if the person’s education level is primary} \\
0, & \text{otherwise}
\end{cases}
\]

\[
SEC = \begin{cases} 
1, & \text{if the person has passed secondary examination} \\
0, & \text{otherwise}
\end{cases}
\]

\[
HS = \begin{cases} 
1, & \text{if the person’s education level is higher secondary} \\
0, & \text{otherwise}
\end{cases}
\]

\[
GRAD = \begin{cases} 
1, & \text{if the person’s education level is graduation and above} \\
0, & \text{otherwise}
\end{cases}
\]

• **Occupational Groups:**
The incidence of moonlighting varies across occupations. Therefore we consider occupational groups as important determinant of moonlighting decision among the heads of households residing in Hasnabad Block in the state of West Bengal. We classify occupations into three major groups. The first group, salaried class (SAL), consists of heads of households whose primary job is a full time salaried employment either in public or in private sector. The second group, self employed class (SELFEMP) consists of heads of households whose primary activity is not wage earning but self employment. This group includes shop keeper, business man, farmers who held at least three bighas of
land etc. The third group consists of the rest of occupations. First two groups of occupations, SAL and SELFEMP are considered as exogenous variables in our empirical study. We assign ‘1’ if a person belongs to a particular occupational group.

\[
\begin{align*}
\text{SAL} = & \begin{cases} 
1, & \text{if the person is primarily employed in full time salaried job} \\
0, & \text{otherwise}
\end{cases} \\
\text{SELFEMP} = & \begin{cases} 
1, & \text{if the person belongs to the self employed group} \\
0, & \text{otherwise}
\end{cases}
\end{align*}
\]

- **Age:**
  Age, as a proxy of experience, is an important determinant of moonlighting decision. Age is measured in years. We consider age as a continuous variable.

- **Annual income:**
  From equations (3.3.18) and (3.3.26) it is clear that income is one of the key factors determining moonlighting labor supply. Therefore we consider income as one of the important explanatory variables. A considerable portion of the moonlighting respondents in our survey denied providing data about actual figure of their secondary incomes. This may be due to some shadow activities attached with the moonlighting job. Therefore, we consider the income variable (INC) as annual income from primary sources (including asset income) in tradition with Naderi (2003). We consider logarithm of annual income (ln INC) in our estimation process as a continuous variable for the purpose of finding out the degree of influence of annual income on the probability of moonlighting.

- **Hours worked in primary job (HWPJ):**
  To judge the responsibility of hours constraint in determining the probability of moonlighting, we consider a continuous explanatory variable, the average number of hours supplied to perform the primary job.
• **Financial Inclusion:**
To measure the influence of financial inclusion on the decision to moonlight, we consider a categorical variable. The holding of a bank account has been considered as a measure of financial inclusion. Financially included persons are expected to be more likely to moonlight because extra earnings either from primary or moonlighting jobs may provide further interest income from a savings account or fixed deposit in a bank. We assign value ‘1’ if the head of family has at least one bank account.

\[
\text{BANK} = \begin{cases} 
1, & \text{if the person holds at least one bank account} \\
0, & \text{otherwise}
\end{cases}
\]

• **Other Earning Members in the Family:**
It is expected that if earning members in a family increases, moonlighting probability of the head of the family should decrease. We consider other earning members in the family (EMEM) as an important determinant of moonlighting decision of the head of household.

• **Dependent Members in the Family:**
It is expected that if the number of dependent family members increases, the head of the family would try to moonlight for enhanced financial need. We consider dependents in the family (DEPN) as an important determinant of moonlighting decision of the head of household.

• **Religion:**
Religion (RELG) is supposed to affect the decision to moonlight. We have classified households into two groups, Hindu and non-Hindu. If the head of household belongs to the Hindu community we assign the value ‘1’ and ‘0’ otherwise.

\[
\text{RELG} = \begin{cases} 
1, & \text{if the person belongs to Hindu community} \\
0, & \text{otherwise}
\end{cases}
\]

The list of variables does not include sex as an explanatory variable. Since female heads of households is very uncommon in the region of our study, we exclude female heads of households
from our sample and consider only 348 male heads of households for our empirical analysis. Since no urban people are residing in the block of Hasnabad, the list of variables does not include urban/rural as categorical variable.

3.4.3. Specification of Models
In order to study the impact of several factors on moonlighting decision, we have planned to estimate two models.

Model 1: Years of schooling is a continuous variable

\[ MOON_i = \alpha_0 + \alpha_1 AGE + \alpha_2 YSCHOOL + \alpha_3 SAL_i + \alpha_4 SELFEMP_i + \alpha_5 \ln INC_i + \alpha_6 HWPJ_i + \alpha_7 BANK_i + \alpha_8 EMEM_i + \alpha_9 DEPN_i + \alpha_{10} RELG_i + U_i \] (3.4.24)

Model 2: Years of schooling is a dummy for different levels of education

\[ MOON_i = \beta_0 + \beta_1 AGE + \beta_2 PRM_i + \beta_3 SEC_i + \beta_4 HS_i + \beta_5 GRAD_i + \beta_6 \ln INC_i + \beta_7 SELFEMP_i + \beta_8 HWPJ_i + \beta_9 BANK_i + \beta_{10} EMEM_i + \beta_{11} DEPN_i + \beta_{12} RELG_i + U_i \] (3.4.25)

To estimate models like (3.4.24) and (3.4.25), we have to follow the technique of binary response model. To estimate the log odds in favour of moonlighting decision, this study is entrusted to provide a logit estimation of equation (3.4.24) and (3.4.25). The \( t \) values of estimated coefficients are considered for inference and prediction analysis.

3.4.4. Data, Empirical Results and Discussion
For empirical analysis of determinants of moonlighting we have used a data set collected from Hasnabad Block of West Bengal during the month of August 2011. Our sample households have been selected using random number method. There are 73 inhabited villages in Hasnabad Block. In the first stage of sampling we select the villages at random using simple random sampling method. In the final stage of sampling we choose the households in each village at random by the
method of simple random sampling with replacement using the draw of random number. Among 34959 households we have surveyed 355 heads of households using random sampling and house to house survey. Among those 355 households, only 7 heads of households are female. Therefore we keep out female heads of households from our sample and consider only 348 male heads of households for our empirical analysis. Since no urban people are residing in the block of Hasnabad, the list of variables does not include urban/rural as categorical variable. Because of data limitation, we are not able to examine job-heterogeneity motive of moonlighting and to evaluate the effects of wage rates paid on the first and second job separately on time allocation behavior of the people in Hasnabad.

Table - 3.4.2: Percentage Distribution of Categorical Variables in the sample N=348

<table>
<thead>
<tr>
<th>Categorical Variables</th>
<th>Percentage of Sample Observations Having Values</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOON</td>
<td></td>
<td>73.56</td>
<td>26.44</td>
</tr>
<tr>
<td>PRM</td>
<td></td>
<td>50.29</td>
<td>49.71</td>
</tr>
<tr>
<td>SEC</td>
<td></td>
<td>79.31</td>
<td>20.69</td>
</tr>
<tr>
<td>HS</td>
<td></td>
<td>89.66</td>
<td>10.34</td>
</tr>
<tr>
<td>GRAD</td>
<td></td>
<td>85.34</td>
<td>14.66</td>
</tr>
<tr>
<td>SAL</td>
<td></td>
<td>75.29</td>
<td>24.71</td>
</tr>
<tr>
<td>SELFEMP</td>
<td></td>
<td>45.4</td>
<td>54.6</td>
</tr>
<tr>
<td>BANK</td>
<td></td>
<td>24.43</td>
<td>75.57</td>
</tr>
<tr>
<td>RELG</td>
<td></td>
<td>41.67</td>
<td>58.33</td>
</tr>
</tbody>
</table>

Source: Primary Survey in Hasnabad Block, West Bengal

Table – 3.4.2 provides the percentage distribution of categorical variables. From the table it is clear that only 26.44% of sample heads of households moonlight. It has been seen that 49.71% heads of households in our sample have only primary education, 20.69% are matriculate (possesses secondary level education), 10.34% passed higher secondary and only 14.66% is higher educated (Graduate and above). Among 348 heads of households, 24.71% are salaried in either private or public sectors, 54.61% are self-employed either in agriculture (farmer) or self-employed in secondary/tertiary sector. Nearly 75% surveyed population has bank account. Among 348 heads of households, 58.33% belongs to Hindu Community.

Table - 3.4.3 provides the summary statistics of quantitative variables. From this table it is clear that the average age of working heads of families is 43.47, varies from 22 years to 67 years.
Years of schooling of the persons in our sample varies from 0 years (illiterate) to 17 years (post graduation degree) with an average of 7.6 years. Average annual income from the prime job varies from Rs. 18250 to a moderately high level Rs. 1095000, with an average of nearly Rs. 115153.30 in our sample. Spending of labor hour into primary job varies from 2 to 12 hours. Other earning member in the family varies from 0 to 4 with an average of 0.58. Number of dependents in a family in our sample is 2.75 in average, varies from 0 to 7.

Table - 3.4.3. Summary Statistics of Quantitative Variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>C.V.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>43.47</td>
<td>43.00</td>
<td>9.49</td>
<td>0.22</td>
<td>22.00</td>
<td>67.00</td>
</tr>
<tr>
<td>YSCHOOL</td>
<td>7.55</td>
<td>4.00</td>
<td>4.69</td>
<td>0.62</td>
<td>0.00</td>
<td>17.00</td>
</tr>
<tr>
<td>INC</td>
<td>115153.30</td>
<td>91250.00</td>
<td>99074.40</td>
<td>0.86</td>
<td>18250.00</td>
<td>1095000.00</td>
</tr>
<tr>
<td>HWPJ</td>
<td>7.78</td>
<td>8.00</td>
<td>1.79</td>
<td>0.23</td>
<td>2.00</td>
<td>12.00</td>
</tr>
<tr>
<td>EMEM</td>
<td>0.58</td>
<td>0.00</td>
<td>0.85</td>
<td>1.48</td>
<td>0.00</td>
<td>4.00</td>
</tr>
<tr>
<td>DEPN</td>
<td>2.75</td>
<td>3.00</td>
<td>1.13</td>
<td>0.41</td>
<td>0.00</td>
<td>7.00</td>
</tr>
<tr>
<td>lnINC</td>
<td>11.45</td>
<td>11.42</td>
<td>0.59</td>
<td>0.05</td>
<td>9.81</td>
<td>13.91</td>
</tr>
</tbody>
</table>

Source: Primary Survey in Hasnabad Block, West Bengal

Table - 3.4.3 provides the summary statistics of quantitative variables. From this table it is clear that the average age of working heads of families is 43.47, varies from 22 years to 67 years. Years of schooling of the persons in our sample varies from 0 years (illiterate) to 17 years (post graduation degree) with an average of 7.6 years. Average annual income from the prime job varies from Rs. 18250 to a moderately high level Rs. 1095000, with an average of nearly Rs. 115153.30 in our sample. Spending of labor hour into primary job varies from 2 to 12 hours. Other earning member in the family varies from 0 to 4 with an average of 0.58. Number of dependents in a family in our sample is 2.75 in average, varies from 0 to 7.

Table -3.4.4A: Correlation coefficients, using the observations 1 – 348

<table>
<thead>
<tr>
<th>MOON</th>
<th>AGE</th>
<th>YSCHOOL</th>
<th>PRM</th>
<th>SEC</th>
<th>MOON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>-0.06</td>
<td>-0.06</td>
<td>-0.01</td>
<td>-0.02</td>
<td>MOON</td>
</tr>
<tr>
<td>1.00</td>
<td>0.06</td>
<td>-0.03</td>
<td>0.01</td>
<td>AGE</td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>-0.75*</td>
<td>0.27*</td>
<td>YSCHOOL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>-0.51*</td>
<td>PRM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>SEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s own calculation based on primary data. * stands for significant at 1% level, ** stands for significant at 5% level, *** stands for significant at 10% level.
Tables 3.4.4A, 3.4.4B, 3.4.4C provide the correlation matrix to understand nature of association between different variables. Most of the coefficients are significant and are satisfying logically expected signs and magnitudes. The correlation matrix ensures that there is no problem of multicollinearity. For further confirmation of the presence of multicollinearity between explanatory variables, we present Variance Inflation factors (VIF) in table 3.4.8. The values of VIF confirmed that there is no problem of multicollinearity among explanatory variables.

The findings of logit estimation of equation (3.4.24) and (3.4.25), based on cross section data of 348 heads of households residing at Hasnabad Block of West Bengal are presented in table – 3.4.5 and table – 3.4.6 respectively. These tables reveal the reasons why the heads of households residing in Hasnabad Block decide for moonlighting. Table -3.4.7 tabulates the marginal changes in probabilities due to one unit change in the determinants of moonlighting for both models.
Table -3.4.4C: Correlation coefficients, using the observations 1 – 348

<table>
<thead>
<tr>
<th>BANK</th>
<th>EMEM</th>
<th>DEPN</th>
<th>RELG</th>
<th>lnINC</th>
<th>MOON</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.16**</td>
<td>-0.04</td>
<td>0.09***</td>
<td>0.14*</td>
<td>-0.17*</td>
<td></td>
</tr>
<tr>
<td>0.08</td>
<td>0.41*</td>
<td>0.04</td>
<td>0.07</td>
<td>0.20*</td>
<td>AGE</td>
</tr>
<tr>
<td>0.26*</td>
<td>-0.13*</td>
<td>-0.09***</td>
<td>0.32*</td>
<td>0.50*</td>
<td>YSCHOOL</td>
</tr>
<tr>
<td>-0.16*</td>
<td>0.08</td>
<td>0.07</td>
<td>-0.29*</td>
<td>-0.31*</td>
<td></td>
</tr>
<tr>
<td>-0.01</td>
<td>-0.02</td>
<td>0.01</td>
<td>0.19*</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>0.11**</td>
<td>-0.08</td>
<td>0.00</td>
<td>0.19*</td>
<td>0.11**</td>
<td></td>
</tr>
<tr>
<td>0.20*</td>
<td>-0.06</td>
<td>-0.12**</td>
<td>0.10***</td>
<td>0.41*</td>
<td></td>
</tr>
<tr>
<td>0.26*</td>
<td>-0.10***</td>
<td>-0.05</td>
<td>0.24*</td>
<td>0.51*</td>
<td></td>
</tr>
<tr>
<td>0.06</td>
<td>0.04</td>
<td>0.15*</td>
<td>-0.16*</td>
<td>-0.10***</td>
<td></td>
</tr>
<tr>
<td>-0.09***</td>
<td>-0.11**</td>
<td>-0.02</td>
<td>-0.04</td>
<td>-0.25</td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>-0.11**</td>
<td>0.01</td>
<td>0.10***</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>0.00</td>
<td>-0.12**</td>
<td>-0.12**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>0.00</td>
<td>-0.13</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>0.00</td>
<td>0.17*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s own calculation based on primary data. * stands for significant at 1% level, ** stands for significant at 5% level, *** stands for significant at 10% level.

Age, as a proxy of experience, is an important determinant of moonlighting decision. In the studies of Naderi (2000), Hyder and Ahmed (2011), Conway and Kimmel (1998), Dickey and Theodossiou (2004) and Livanos and Zangelidis (2008), Combos, McKay and Wright (2007), Renna and Oaxaca (2006), age appeared as one of the significant determinants of moonlighting decision. But in the study of Foley (1997), age appeared as an insignificant determinant of moonlighting. In our study, with reference to table 3.4.5 and 3.4.6, the coefficient of AGE is -0.002 in both model 1 and 2. The coefficients of AGE in both models are insignificant. The results are indicative that old aged persons are less likely to moonlight. The change in odds ratio indicates that due to one year increase in age, moonlighting decreases only at (exp(-0.002)-1)*100=0.20 percent in model 1 and in model 2. With reference to table – 3.4.7, this study concludes that the probability of being moonlighter decreases by 0.038 percent in model-1 and by 0.031 percent in model – 2 due to one year increase in age, given the set of other explanatory variables.
Level of education has some positive role to improve the quality of human capital and therefore it is expected to have some influence upon moonlighting decision. Improved labor quality acquired through higher education provides a person higher competency in the labor market. This improved quality of labor decreases the probability of moonlighting through raising the reservation wage rate \( w^2 \). On the other hand this improved quality of labor stimulates actual wage rate which raises the probability of moonlighting. Therefore effects of education on moonlighting probability are ambiguous. The studies of Naderi (2000), Wu, Baimbridge and Zu(2008), Tansel (1995) and Dickey and Theodossiou (2004) have advocated some significant effect of education on moonlighting decision while Foley (1997), Hyder and Ahmed (2011) have not found any such effect. Coefficient of YSCHOOL in model 1 is significant at 17 percent level.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>const</td>
<td>18.381</td>
<td>4.090</td>
<td>4.494</td>
<td>0.000</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.002</td>
<td>0.017</td>
<td>-0.133</td>
<td>0.894</td>
</tr>
<tr>
<td>YSCHOOL</td>
<td>0.051</td>
<td>0.037</td>
<td>1.370</td>
<td>0.171</td>
</tr>
<tr>
<td>SAL</td>
<td>-0.701</td>
<td>0.538</td>
<td>-1.302</td>
<td>0.193</td>
</tr>
<tr>
<td>SELFEMP</td>
<td>0.225</td>
<td>0.379</td>
<td>0.594</td>
<td>0.552</td>
</tr>
<tr>
<td>HWPJ</td>
<td>-0.308</td>
<td>0.086</td>
<td>-3.602</td>
<td>0.000</td>
</tr>
<tr>
<td>BANK</td>
<td>1.961</td>
<td>0.407</td>
<td>4.818</td>
<td>0.000</td>
</tr>
<tr>
<td>EMEM</td>
<td>-0.278</td>
<td>0.184</td>
<td>-1.510</td>
<td>0.131</td>
</tr>
<tr>
<td>DEPN</td>
<td>0.202</td>
<td>0.125</td>
<td>1.612</td>
<td>0.107</td>
</tr>
<tr>
<td>RELG</td>
<td>-0.610</td>
<td>0.289</td>
<td>-2.108</td>
<td>0.035</td>
</tr>
<tr>
<td>lnINC</td>
<td>-1.662</td>
<td>0.378</td>
<td>-4.400</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Mean of MOON = 0.264
Number of cases 'correctly predicted' = 273 (78.4%)
f(\beta'x) at mean of independent vars = 0.170
McFadden's pseudo-\( R^2 \) = 0.169063
Log-likelihood = -167.015
Likelihood ratio test: Chi-square(10) = 67.9621 (p-value 0.000000)
Akaike information criterion (AIC) = 356.031
Schwarz Bayesian criterion (BIC) = 398.405
Hannan-Quinn criterion (HQC) = 372.901

Source: Author’s own calculation based on primary data.
In model 2, only coefficient of PRM is significant at 17 percent level while coefficients of SEC, HS and GRAD are insignificant. Further, the absolute value of the coefficients of PRM, SEC, HS, GRAD in model 2 decreases with levels of education. Due to one unit increase in the years of schooling, the odds in favour of moonlighting increases only by \((\exp(0.051)-1)\times100=5.23\) percent in model 1. In model 2, except for HS, all coefficients of PRM, SEC, GRAD are negative. The change in odds ratio indicates that there is a fall in the moonlighting to the extent of \((\exp (-0.864)-1)\times100=57.84\) percent for a person with only primary education (PRM), \((\exp (-0.418)-1)\times100=34.16\) percent for a matriculate person (SEC) and \((\exp(-0.229)-1)\times100=20.47\) percent for a higher educated person (GRAD). However, for a person with intermediate degree (HS), the change in odds ratio indicates that the moonlighting increases to the extent of \((\exp(0.032)-1)\times100=3.25\) percent only. The table – 3.4.7 shows that the probability of being moonlighter by an employed person decreases by only 0.857 percent in model-1 due to one year increase in schooling, given the set of other explanatory variables. In model – 2, given the set of other explanatory variables, the probability of being moonlighter decreases by 14.6 percent for persons with primary education, 7.07 percent for matriculates 3.87 percent for graduates and increases by 0.54 percent for persons with intermediate degree.

The coefficient of SAL (persons belonging to the salaried class) is negative for both models, which is indicative that salaried persons are less likely to moonlight. In model 1, the coefficient of SAL is significant at 19 percent level while in model 2 the coefficient of SAL is significant at 22 percent. The change in odds ratio indicates that for salaried persons in Hasnabad Block, there is a decrease in moonlighting to the extent \((1-\exp(-0.701))\times100=50.39\) percent in model 1 and \((1-\exp(-0.670))\times100=48.83\) percent in model 2. From the table 3.4.7, we note that, *ceteris paribus*, the probability of being moonlighter by salaried persons decreases by 11.89 percent in model 1 and 11.33 percent in model 2 respectively.

Similarly, the coefficient of SELFEMP (persons who are self-employed) is positive which is indicative that self-employed persons are more likely to moonlight. But the coefficients of SELFEMP in both the models are insignificant. For self-employed persons the log of odds favouring moonlighting compared to other working groups, increases by almost 22.5 percent in model 1 and 33.4 percent in model 2. The change in odds ratio indicates that for self employed
persons in Hasnabad Block, there is an increase in moonlighting to the extent \((\exp(0.225) - 1) \times 100 = 25.23\%\) in model 1 and \((\exp(0.334) - 1) \times 100 = 39.65\%\) in model 2. The table 3.4.7 suggests that, \(ceteris paribus\), the probability of being a moonlighter by self employed persons increases by 3.82 percent in model 1 and 5.64 percent in model 2, given the set of other explanatory variables.

Table 3.4.6: Logit estimates of Model 2
Dependent variable: MOON
Convergence achieved after 6 iterations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>const</td>
<td>18.787</td>
<td>4.120</td>
<td>4.560</td>
<td>0.000</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.002</td>
<td>0.017</td>
<td>-0.110</td>
<td>0.913</td>
</tr>
<tr>
<td>PRM</td>
<td>-0.864</td>
<td>0.631</td>
<td>-1.369</td>
<td>0.171</td>
</tr>
<tr>
<td>SEC</td>
<td>-0.418</td>
<td>0.693</td>
<td>-0.604</td>
<td>0.546</td>
</tr>
<tr>
<td>HS</td>
<td>0.032</td>
<td>0.781</td>
<td>0.041</td>
<td>0.967</td>
</tr>
<tr>
<td>GRAD</td>
<td>-0.229</td>
<td>0.776</td>
<td>-0.295</td>
<td>0.768</td>
</tr>
<tr>
<td>SAL</td>
<td>-0.670</td>
<td>0.545</td>
<td>-1.230</td>
<td>0.219</td>
</tr>
<tr>
<td>SELFEMP</td>
<td>0.334</td>
<td>0.388</td>
<td>0.861</td>
<td>0.389</td>
</tr>
<tr>
<td>HWPJ</td>
<td>-0.310</td>
<td>0.086</td>
<td>-3.603</td>
<td>0.000</td>
</tr>
<tr>
<td>BANK</td>
<td>1.982</td>
<td>0.414</td>
<td>4.792</td>
<td>0.000</td>
</tr>
<tr>
<td>EMEM</td>
<td>-0.288</td>
<td>0.186</td>
<td>-1.551</td>
<td>0.121</td>
</tr>
<tr>
<td>DEPN</td>
<td>0.194</td>
<td>0.127</td>
<td>1.529</td>
<td>0.126</td>
</tr>
<tr>
<td>RELG</td>
<td>-0.644</td>
<td>0.298</td>
<td>-2.158</td>
<td>0.031</td>
</tr>
<tr>
<td>lnINC</td>
<td>-1.620</td>
<td>0.378</td>
<td>-4.283</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Mean of MOON = 0.264
Number of cases 'correctly predicted' = 268 (77.0%)
f(\beta'x) at mean of independent vars = 0.169
McFadden's pseudo-R2 = 0.177577
Log-likelihood = -165.304
Likelihood ratio test: Chi-square(13) = 71.3848 (p-value 0.000000)
Akaike information criterion (AIC) = 358.608
Schwarz Bayesian criterion (BIC) = 412.539
Hannan-Quinn criterion (HQC) = 380.079

Source: Author’s own calculation based on primary data.

The most important factor that motivates a person to moonlight is the failure of persons to sell as much work hour as they desire at their utility maximizing level. The studies by Shishko and Rostker (1976), Conway and Kimmell (1998), Boheim and Taylor (2004), Dickey and Theodossiou (2004) and Livanos and Zangelidis (2008) confirmed that hours constraint plays
major role in shaping moonlighting decision. With reference to the tables 3.4.5 and 3.4.6, hours worked in primary job (HWPJ) is a significant determinant of the decision to moonlight (at one percent level).

The coefficients of HWPJ are -0.308 and -0.310 in models 1 and 2 respectively. This implies that for unit increase in the working hour in primary job decreases the log of odds in favour of moonlighting by about 0.308 in model 1 and 0.310 in model 2. Thus the change in odds ratio in favour moonlighting is $(\exp(-0.308) - 1) \times 100 = 26.5$ percent in model 1 and $(\exp(-0.31) - 1) \times 100 = 26.65$ in model 2. Table 3.4.7 suggests that the probability of being a moonlighter decreases due to one unit increase in working hour of primary job by 5.23 percent in model 1 and 5.25 percent in model 2, given the set of other explanatory variables.

The holding of a bank account has been considered, for the sake of simplicity, as a measure of financial inclusion. To assess the role of financial inclusion in shaping moonlighting decision, we have considered holding at least one bank account (BANK) as an important determinant. The coefficients of BANK are positive and significant in one percent level in both models 1 and 2. Therefore we conclude that holding a bank account increases the log of odds in favour of moonlighting by almost 1.961 in model 1 and 1.982 in model 2 compared to that of those without any bank account. The slope coefficients of BANK in table 3.4.7 imply that, ceteris paribus, the probability of decision to moonlight of bank account holder increases by 33.28 percent in model 1 and 33.52 percent in model 2.

Other earning members in the family provide financial support to the head of households. Therefore a negative effect of other earning members in the family (EMEM) on moonlighting decision is expected. The coefficient of EMEM is -0.278 in model 1 which is significant at 13 percent level. The coefficient of EMEM is -0.288 in model 2 which is significant at 12 percent level. For one extra earning member of the family, the decrease in odds ratio in favour of moonlighting is $(\exp(-0.278) - 1) \times 100 = 24.27$ percent in model 1 and 25 percent in model 2. Table 3.4.7 suggests that, holding other things same, the probability of being a moonlighter decreases due to an additional earning member to the extent of 4.7 percent in model 1 and 4.9 percent approximately in model 2.
We observe that the coefficients of number of dependent family members (DEPN) are positive which implies that dependent family members induce the head of the family to search for additional jobs. In model 1 number of dependent family members affects moonlighting decision of heads of families at 11 percent level of significance. Similarly in model 2 the number of dependent family members affects the moonlighting decision of heads of families at 13 percent level of significance. The estimated logit models show that an additional dependent family member increases the log of odds favouring moonlighting by about 0.202 in model 1 and 0.194 in model 2. The change in odds ratio indicates that for an additional dependent family member in Hasnabad Block, there is an increase in moonlighting to the extent of \((\exp(0.202)-1)*100=22.38\) percent in model 1 and \((\exp(0.194)-1)*100=21.4\) percent in model 2. However if we look at the marginal probabilities in table 4.3.7, for an additional dependent family member the marginal probability of moonlighting increases by 3.4 percent in model 1 and 3.3 percent in model 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>const</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>-0.00038</td>
<td>-0.00031</td>
</tr>
<tr>
<td>YSCHOOL</td>
<td>0.00857</td>
<td></td>
</tr>
<tr>
<td>PRM</td>
<td>-0.14608</td>
<td></td>
</tr>
<tr>
<td>SEC</td>
<td>-0.07074</td>
<td></td>
</tr>
<tr>
<td>HS</td>
<td>0.00544</td>
<td></td>
</tr>
<tr>
<td>GRAD</td>
<td>-0.03874</td>
<td></td>
</tr>
<tr>
<td>SAL</td>
<td>-0.11887</td>
<td>-0.11333</td>
</tr>
<tr>
<td>SELFEMP</td>
<td>0.03822</td>
<td>0.05645</td>
</tr>
<tr>
<td>HWPJ</td>
<td>-0.05228</td>
<td>-0.05250</td>
</tr>
<tr>
<td>BANK</td>
<td>0.33278</td>
<td>0.33519</td>
</tr>
<tr>
<td>EMEM</td>
<td>-0.04715</td>
<td>-0.04866</td>
</tr>
<tr>
<td>DEPN</td>
<td>0.03422</td>
<td>0.03278</td>
</tr>
<tr>
<td>RELG</td>
<td>-0.10353</td>
<td>-0.10893</td>
</tr>
<tr>
<td>InINC</td>
<td>-0.28196</td>
<td>-0.27393</td>
</tr>
</tbody>
</table>

Source: Author’s own calculation based on primary data.

In our study, the coefficient of religion dummy (RELG) is seen as negative (-0.61 in model 1 and -0.644 in model 2) and it implies that log likelihood in favour of moonlighting for Hindu community declines in contrast to that of others. The coefficient of RELG is statistically
significant in 5 percent level in both models and the change in odds ratio implies that there is a
decrease in moonlighting to the extent of \[ \exp (-0.61) - 1 \times 100 = 45.66 \] percent in model 1 and \[ \exp (-0.644) - 1 \times 100 = 47.48 \] in model 2 for the Hindus contrasted with those who are not. Marginal probability of moonlighting for Hindus, as is evident from table 4.3.7, decreases by 10.35 percent in model 1 and 10.89 percent in model 2, given the set of other explanatory variables.

The effect of annual income from primary job (lnINC) on moonlighting decision is expected to be negative for a constrained moonlighter. The estimated coefficients of ln INC are -1.662 in model 1 and -1.620 in model 2, which are statistically significant at one percent level. For one unit increase in the level of income, the odds ratio in favour of moonlighting decreases to the extent of 81 percent in model 1 and 80 percent in model 2. Table 4.3.7 suggests that, given the set of other explanatory variables, the probability of moonlighting will decrease by 28 percent in model 1 and 27 percent in model 2.

Table – 3.4.8: Variance Inflation Factors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>1.325</td>
<td>1.326</td>
</tr>
<tr>
<td>YSCHOOL</td>
<td>1.631</td>
<td></td>
</tr>
<tr>
<td>PRM</td>
<td></td>
<td>6.255</td>
</tr>
<tr>
<td>SEC</td>
<td></td>
<td>4.865</td>
</tr>
<tr>
<td>HS</td>
<td></td>
<td>3.381</td>
</tr>
<tr>
<td>GRAD</td>
<td></td>
<td>4.444</td>
</tr>
<tr>
<td>SAL</td>
<td>2.754</td>
<td>2.765</td>
</tr>
<tr>
<td>SELFEMP</td>
<td>2.072</td>
<td>2.118</td>
</tr>
<tr>
<td>HWPJ</td>
<td>1.191</td>
<td>1.213</td>
</tr>
<tr>
<td>BANK</td>
<td>1.359</td>
<td>1.364</td>
</tr>
<tr>
<td>EMEM</td>
<td>1.31</td>
<td>1.309</td>
</tr>
<tr>
<td>DEPN</td>
<td>1.055</td>
<td>1.067</td>
</tr>
<tr>
<td>RELG</td>
<td>1.164</td>
<td>1.199</td>
</tr>
<tr>
<td>lnINC</td>
<td>2.04</td>
<td>2.053</td>
</tr>
</tbody>
</table>

Source: Author’s own calculation based on primary data.
We would conclude this section by a comparative look at the columns of table 3.4.7. The variables that are statistically significant in model 1 are also statistically significant in model 2. Differences in marginal probabilities are seen to be negligible (table - 4.3.7). The most important determinants of moonlighting decision among heads of households in the Hasnabad Block are HWPJ, BANK, EMEM, DEPN, RELG and lnINC. Consideration of education makes no difference in the determinants of moonlighting in Hasnabad. Finally, to judge any presence of multicollinearity, we estimated Variance Inflating Factors^ (VIF) among explanatory variables in table - 3.4.8. No multicollinearity is detected amongst explanatory variables.

In our empirical analysis, we have found that hours worked in primary job (HWPJ) is an important determinant of moonlighting decision of the heads of households residing in Hasnabad Block of West Bengal. This entails the validation of the ‘hours constraint’ as one of the prime motivating force of moonlighting decision by the heads of families in Hasnabad Block. Since the coefficients of HWPJ are negative and significant in both models, increase in HWPJ will surely reduce the probability of moonlighting. Therefore, those heads of families are constrained in their primary job so that any increase in HWPJ affect negatively to the moonlighting decision. Secondly, the decision to moonlight is negatively affected by income from primary job. As increased income from primary job lowers the probability of moonlighting (log odds of moonlighting), it may be concluded that moonlighters in Hasnabad Block are income constrained. They could not earn as much income as they want to maintain their livelihood and therefore opted to moonlight. We can conclude that heads of households of Hasnabad moonlight primarily due to financial reasons. Our analysis further confirmed that financially included persons (bank account holders) are more likely to be a moonlighter. Heads of Hindu families are less likely to moonlight than others. Occupational status and the level of education are not so important to determine moonlighting probability of family heads in Hasnabad. Therefore, the heads of families in Hasnabad do moonlight due to financial reasons.

3.5. The Political Business Cycle of Moonlighting
In the previous sections, we have discussed the economic and socio-demographic causes of moonlighting. After a theoretical journey into constraint and job heterogeneity motives of moonlighting, we have empirically established the fact that heads of families in Hasnabad do
moonlight due to financial reasons. Among various motives of moonlighting, the presence of hours constraint in the primary employment is empirically validated as one of the prime causes of moonlighting. In this section, we intend to show that the rate of moonlighting in a nation is a matter of political choice. In other words, in addition to various reasons affecting moonlighting decision of individuals, we suggest that the political will of the governmental authorities to move against moonlighting or to favour moonlighting through various administrative and fiscal measures can externally determine moonlighting rate. More specifically, we study the existence of political business cycle (PBC) to explain the incidence of moonlighting.

We already have spotlighted that moonlighting is one of the important reasons behind the shadow economy in chapter one. To stay away from ill effects of moonlighting, the political party in power have the opportunity to act against the incidence of moonlighting. If the incumbent party really decide to act against moonlighting to enjoy favour from the voters in the next election, the incidence (rate) of moonlighting should follow a cyclical path between various election periods. This constitutes the political business cycle of moonlighting.

3.5.1. Definition of the Political Business Cycle (PBC)

The political business cycle (PBC) refers to the fact that the political party in power (incumbent party) will follow some expansionary policies prior to elections for the urge of being re-elected. In this situation the outcomes of economic variables are induced mainly by the political accomplishments. The political controls of economic outcomes for maximization of vote generate political business cycle. Almost all democratic nations have some experience of political business cycle.

In the literature of political business cycle theory, it is assumed that the political parties in power have some ‘ability’ to manipulate (manage or control) the economy. The incumbent party uses this ability to promote economic prosperity in times of election to gain the opportunity of being re-elected. In the political business cycle theory, the political parties are assumed to be guided by their political opportunism.
The theory of political business cycle has two main strands, namely the opportunistic political business cycle (OPBC) and the partisan political business cycle (PPBC). In the opportunistic political business cycle (OPBC) theory, it is presumed that the citizens’ decision to vote solely depends upon their economic positions in times of elections. Nordhaus (1975), an early proponent of the opportunistic political business cycle (OPBC) theory, illustrated that the party in administrative power tries to stimulate the economy to raise output and employment growth prior to elections to improve the chance of re-election. But to reach the results, he assumed that citizens’ expectations are adaptive and thus they (citizens) are voting retrospectively. Lindbeck (1976), McRae (1977), Tufte (1978) have supported the political opportunism as a proximate determinant of economic outcomes. Cukierman and Meltzer (1986), Rogoff and Sibert (1988), Rogoff (1990), Persson and Tabellini (1990), Stein and Streb (1998), Lohmann (1998) have revised the Nordhaus model by regarding rational expectation behaviour of citizens. Using asymmetric information between voters and political parties, their studies supported the presence of opportunistic political business cycle in shaping economic outcomes.

The partisan political business cycle (PPBC) was proposed as an alternative to the opportunistic political business cycle (OPBC). Hibbs (1977) argued that political parties’ decide according to their political ideologies, not to their political opportunism. This alternative of political business cycle theory is named as partisan theory after realising the fact that in most cases political ideologies outweigh the political opportunism. The proponents of partisan political business cycle (PPBC) refer to the fact that the leftist political parties emphasize more on lowering unemployment, providing more social security, health care, public education, economic growth and relatively disregards high inflation, budget deficit etc. On the other hand, the right wing political parties give more importance to lower inflation rate than unemployment and try to impose free market economy (globalization). Hibbs reserved Nordhaus’s characterization of retrospective voters. There is little empirical support behind the partisan political business cycle theory.

The partisan political business cycle (PPBC) was extended to a rational expectations framework by Chappell and Keech (1986) and Alesina (1987, 1988). Kraus and Mendez (2005) and Bloomberg and Hess (2003) have illustrated some evidence of partisan theory. Clark and
Hallerberg (2000) have studied changes in monetary or fiscal policy in the OECD countries. Their findings prove no evidence of partisan PBC in the OECD countries. Nannestad and Paldam (1994) have confirmed that models with retrospective voters (opportunistic PBC) have a better empirical fit than models with prospective voters (partisan PBC).

To explain the change in the rate of moonlighting as a result of Political Business Cycle, the use of partisan PBC is inappropriate since both the left and right wing parties disfavor shadow activities caused by moonlighting. In this study we delve into the opportunistic political business cycle (OPBC) to explain the dynamics of moonlighting.

3.5.2. Analytical Framework of the Model
Nordhaus pioneered the theory of political business cycle to explain fluctuations in macroeconomic indicators during election times using Phillips relation between inflation and unemployment. We extend the Nordhaus theory of PBC to explain the rate of change of moonlighting using an inverse relationship between moonlighting growth and unemployment. To outline the theory of Political Business Cycle of Moonlighting, the relationship between moonlighting and unemployment is important.

Although Stinson (1987) pointed on some evidence of large growth of moonlighting during economic expansion despite its non-responsiveness in recessions using national time series of moonlighting between 1960 and 1970 in the U.S., the study of Employment Policy Institute (1999) has established a positive relationship between moonlighting and unemployment. But the positive relationship between the rate of moonlighting and the rate of unemployment is not supported in the recent studies. After realising the fact that chance of moonlighting increases during the periods of economic expansion, Amuedo-Dorantes and Kimmel (2005) have concluded about negative relationship between moonlighting and unemployment. The study of Partridge (2002) supports the evidence of pro-cyclicality between moonlighting and unemployment in the way that moonlighting may rise during periods of rapid economic growth and labor shortages (low unemployment). Naderi (2000) found that moonlighting affects significantly unemployment rate of Iranian labor market. Alper and Wassail (2000) noted “…moonlighting is more common when unemployment is low and the economy is strong”. To
get a formal result behind the relationship between moonlighting and unemployment, we consider an advanced economy with heterogeneity in job market.

Rubery (1989) pointed out the fact that higher demand in the labor market force the economy to suffer from moonlighting in some degree. If the economy faces excess labor demand in the labor market, the wage rate will increase since supply of labor in a particular category is limited by quality. Increase in wage rate will result in raising the value of work-hour relative to leisure and reduce the opportunity cost of holding second job. Hence, excess labor demand increases the incidence of multiple jobholding. We can write, incidence of moonlighting will grow due to excess demand in labor market. i.e., if \( N(t) \) is the absolute number of moonlighters, \( L_d(t) \) and \( L_s(t) \) are labor demand and supply at any time \( t \) respectively. Then

\[
\frac{dN}{dt} = \phi(L_d(t) - L_s(t)) \quad \text{where} \quad \phi'(.) > 0 \quad (3.5.1)
\]

If we consider the rate of unemployment at time \( t \) as \( u(t) = \frac{L_s(t) - L_d(t)}{L_s(t)} \), we can rearrange equation (1) for the growth rate of moonlighting \( n(t) = \frac{1}{N} \frac{dN}{dt} \) as

\[
n(t) = \frac{1}{N} \phi(L_d(t) - L_s(t))
\]

\[
\Rightarrow n(t) = -\frac{1}{N} \phi(u(t)L_s(t))
\]

\[
\Rightarrow u(t) = f(n(t)) \quad \text{where} \quad f'(.) < 0 \quad (3.5.2)
\]

Equation (3.5.2) confirms the inverse relationship between the rate of unemployment and the growth rate of moonlighting.

Now we make some simple assumptions. First, like all political business cycle theorists, the incumbent political party has some power to manipulate the economy. That means the government can regulate \( n(t) \) using administrative and legal apparatus. Second, political parties behave opportunistically. The main objective of the incumbent party is to win the next election. The government is assumed to pursue policies in such a manner that the policies have concrete appeal to the majority of the voters in order to keep on winning at the general elections. The incumbent political party knows the inverse relationship between unemployment and moonlighting; it has two decision variables, the rate of unemployment \( (u(t)) \) and the rate of
growth of moonlighting activities \((n(t))\). Third, the economy suffers from parallel economy considerably and we assume that the primary concern of the electorate is to get rid of the evils of shadow (black) economy. Since moonlighting is considered as one of the major reason behind the formation of shadow economy, reduction in moonlighting will favor the health of the economy. Fourth, citizens also think that reduction of moonlighting will provide more employment opportunities for them since they bear in mind that abolishing moonlighting will free some jobs from the hands of moonlighters. They do not have any idea between inverse (economic) relationship between moonlighting and unemployment. Fifth, the citizens will elect that party which will provide larger assurance for low unemployment rate and low volume of shadow economy. For this reason the citizens watch the rate of growth of moonlighting activities \(n(t)\) to judge the performance of incumbent party. Low rate of growth of moonlighting activities is looked as a larger assurance for low volume of shadow economy and larger assurance for employment generation. Sixth, for better access of the results, we assume that there is ideal democracy in the country. The voters have the power to access full information about the promises and the performances of the political parties. Voters can vote freely and there is no political threat to voters. The opponent parties in the country are so strong that the lack of proper implementation of policies by the incumbent political party may threat it to oust from office via massive vote loss in the next election. Finally, voters vote absolutely on the basis of the performances of the incumbent political party.

Voters’ reaction to any realized value of the rate of unemployment \((u(t))\) and the rate of growth of moonlighting activities \((n(t))\) is captured through a vote function

\[
v(t) = v(u(t), n(t))
\]  

(3.5.3)

Here \(v\) measures the vote getting power of the incumbent party such that high values of \(n(t)\) and \(u(t)\) are both conducive to vote loss. The equation (3.5.3) tells us the political trade-off between \(n(t)\) and \(u(t)\), and gives us iso-vote curves in the \((u,n)\) space for different values of \(v\) as shown in Figure - 3.5.1. The highest iso-vote curve is associated with lowest \(v\), because the incumbent party displeases the voters by producing higher \(n(t)\) and \(u(t)\). Again if the incumbent party displeases the voters by producing higher \(u(t)\), it can hope to gain the vote loss via a larger reduction in \(n(t)\), since voters generally expect that reduction in \(n(t)\) will help the economy to
save from the evils of shadow activities. This implies that the iso-vote curves should be concave. The concave iso-vote curves shows the fact that the incumbent party displeases the voters by producing higher $u(t)$, and to gain the vote loss in election by producing higher $u(t)$, the party may take a policy of reducing $n(t)$ to save the economy from the shadow activities at a higher rate than the rate of increase in the rate of unemployment ($u(t)$).

![Figure - 3.5.1: The iso-vote curves](image)

The political parties know the political trade-off between $n(t)$ and $u(t)$ as specified in eq. (3.5.3). The expectation augmented (or the long run) relationship between $n(t)$ and $u(t)$ can be written as

$$u(t) = f(n(t)) + \alpha u^e(t) \quad \text{where} \quad f'(\cdot) < 0$$  \hspace{1cm} (3.5.4)

Here $u^e(t)$ represent the expected rate of unemployment. Let, as per simple opportunistic PBC framed by Nordhaus, expectations are formed adaptively, according to the following differential equation,

$$\frac{du^e}{dt} = \beta(u(t) - u^e(t)) \quad \text{where} \quad \beta > 0$$ \hspace{1cm} (3.5.5)

The equation (3.5.5) tells us that the change in $u^e(t)$ in each time is made on the basis of adapted values. In this model we can use the expected rate of unemployment ($u^e(t)$) as the state variable and the rate of growth of moonlighting activities ($n(t)$) as the control variable on the assumption
that the governments has the ability to regulate \( n(t) \) at any time using administrative and legal apparatus.

Let’s assume that a political party has won the election at \( t=0 \), and the next election is scheduled to be held on \( T \) years later at \( t=T \). Then the incumbent party has only a total of \( T \) years to influence the voters. At any time in the period \((0,T)\) the actual or realized values of \( n(t) \) and \( u(t) \) will determine specific values of vote getting power \( v \). Citizens have a short collective memory and are influenced more by the economic prosperity occurring near election time. To incorporate this fact we assign heavier weights to the values of \( v(u,n) \) at the latter part of the period \((0,T)\). Let \( r \) is the rate of decay of the collective memory of citizens. The task of the incumbent party is to choose \( n(t) \) which guarantees maximization of \( \int_0^T v(u,n)e^{rt}dt \).

The optimal control problem of the incumbent party is

\[
\begin{aligned}
\text{Max} & \int_0^T v(u,n)e^{rt}dt \\
\text{s.t.} & \frac{d u^e}{dt} = \beta(u(t) - u^e(t)) \\
& u^e(0) = u^e_0, \\
& u^e(T) \text{ is free.}
\end{aligned}
\]  

(3.5.6)

Solving (3.5.6) we get the optimal control path of moonlighting growth rate \( n^*(t) \). If the growth rate of moonlighting increases (\( n^*(t) > 0 \)), then absolute eradication of moonlighting activities from the nation is impossible. If \( n^*(t) = 0 \), then the incumbent party can claim some success of preventing the economy from the growth of moonlighting and shadow activities. Absolute eradication of moonlighting requires the necessary condition \( n^*(t) < 0 \). In the present model, after exploring the properties of \( n^*(t) \) quantitatively, we show that \( n^*(t) > 0 \), for any \( t \in (0,T) \). Hence, complete eradication of moonlighting activities under ideal democracy is impossible. More likely thing is that the optimal path of \( n^*(t) \) will follow a Political Business Cycle.
3.5.3. Quantitative Results and Discussions

To explore properties of $n^*(t)$ quantitatively, we assume (3.5.3) follows the particular form

$$v(t) = -an(t)^2 - bu(t)$$  \hspace{1cm} (3.5.7)

where $a, b > 0$ and $v_a, v_u < 0$. The vote function is concave.

Let us take the particular linear form of eq. (3.5.4) as

$$u(t) = (j - kn(t)) + \alpha u^e(t) \quad \text{where} \quad j, k > 0$$  \hspace{1cm} (3.5.8)

Hence, problem (3.5.6) becomes,

$$\begin{align*}
\max_{n(t)} & \int_0^T \left( -an(t)^2 - b((j - kn(t)) + \alpha u^e(t)) \right) e^{-\alpha t} dt \\
\text{s.t.} & \frac{du^e}{dt} = \beta((j - kn(t)) + \alpha u^e(t) - u^e(t)) \\
& u^e(0) = u_0^e, \\
& u^e(T) \text{ is free.}
\end{align*}$$  \hspace{1cm} (3.5.9)

To solve problem (3.5.9), we form the Hamiltonian as

$$H = \left(-an(t)^2 - b((j - kn(t)) + \alpha u^e(t))\right)e^{-\alpha t} + \lambda \beta\left((j - kn(t)) - (1 - \alpha)u^e(t)\right)$$ \hspace{1cm} (3.5.10)

First order condition to solve (3.5.9) requires that

$$\frac{\partial H}{\partial n(t)} = 0 \Rightarrow (2an(t) - bk)e^{-\alpha t} - \lambda \beta k = 0$$ \hspace{1cm} (3.5.11)

Solving (3.5.11) we get the optimal moonlighting growth path as

$$n^*(t) = \frac{k(b - \lambda \beta e^{-\alpha t})}{2a}$$ \hspace{1cm} (3.5.12)

Since $\frac{\partial^2 H}{\partial n(t)^2} = -2ae^{-\alpha t} < 0$, $n^*(t)$ is the solution of the problem (3.5.9). To achieve the quantitative solution of (3.5.12), let us consider the optimal co-state equation.

The optimal co-state path is

$$\dot{\lambda} = -\frac{\partial H}{\partial u^e(t)} = \left( b\alpha e^{-\alpha t} + \lambda \beta (1 - \alpha) \right)$$ \hspace{1cm} (3.5.13)

which is a first order linear differential equation. Rearranging (3.5.13) we get,

$$\dot{\lambda} - \lambda \beta (1 - \alpha) - b \alpha e^{-\alpha t} = 0$$ \hspace{1cm} (3.5.14)

The complementary function of the differential equation (3.5.14) is
\[ \lambda_c = Ae^{\beta(1-\alpha)t} \]  

(3.5.16)

where \( A \) is an arbitrary constant to be determined from initial conditions.

The particular integral of the differential equation (3.5.14) is

\[ \bar{\lambda} = \frac{b\alpha}{B} e^{rt} \text{ where } B = (r - \beta + \alpha\beta) \]  

(3.5.17)

The solution of the differential equation (3.5.14) is the sum of the complementary function and the particular integral, i.e., the optimal costate path is

\[ \lambda(t) = \lambda_c + \bar{\lambda} = Ae^{\beta(1-\alpha)t} + \frac{b\alpha}{B} e^{rt} \]  

(3.5.18)

Due to vertical terminal line, \( \lambda(T) = 0 \). Using this result in (3.5.18) we get,

\[ \lambda(T) = Ae^{\beta(1-\alpha)T} + \frac{b\alpha}{B} e^{rT} = 0 \]

\[ \Rightarrow Ae^{\beta(1-\alpha)T} = -\frac{b\alpha}{B} e^{rT} \]

\[ \Rightarrow A = -\frac{b\alpha}{B} e^{(r-\beta(1-\alpha))T} = -\frac{b\alpha}{B} e^{BT} \]  

(3.5.19)

Therefore, Using (3.5.19) in (3.5.18) we get,

\[ \lambda(t) = \left( -\frac{b\alpha}{B} e^{BT} \right) e^{\beta(1-\alpha)t} + \frac{b\alpha}{B} e^{rt} \]

\[ \Rightarrow \lambda(t) = \frac{b\alpha}{B} \left( e^{rt} - e^{(BT + \beta(1-\alpha)t)} \right) \]  

(3.5.20)

Using (3.5.20) into (3.12) we get

\[ n^*(t) = \frac{k \left( b - \left( \frac{b\alpha}{B} e^{rt} - e^{(BT + \beta(1-\alpha)t)} \right) \beta e^{-rt} \right)}{2a} \]

\[ \Rightarrow n^*(t) = \frac{kb \left( B - \left( \alpha e^{rt} - e^{(BT + \beta(1-\alpha)t)} \right) \beta e^{-rt} \right)}{2aB} \]

\[ \Rightarrow n^*(t) = \frac{kb \left( r - \beta + \alpha\beta \right) - \left( \alpha\beta - \alpha e^{BT + \beta(1-\alpha)t - rt} \beta \right)}{2aB} \]

\[ \Rightarrow n^*(t) = \frac{kb \left( r - \beta + \alpha\beta \right) - \left( \alpha\beta - e^{BT - (r-\beta(1-\alpha)t)} \alpha\beta \right)}{2aB} \]

\[ \Rightarrow n^*(t) = \frac{kb \left( r - \beta + \alpha\beta \right) + \left( \alpha\beta e^{BT - (r-\beta(1-\alpha)t)} \right)}{2aB} \]
\[ n^*(t) = \frac{kb(r - \beta) + (\alpha \beta e^{B(T - t)})}{2aB} \]

The optimal control path is, therefore,

\[ n^*(t) = \frac{kb(r - \beta) + (\alpha \beta e^{B(T - t)})}{2aB} \quad (3.5.21) \]

The political party in power should follow the optimal path (3.5.10) for the interest of its re-election in year \( T \).

- **Proposition - 3.5.1**
  
  The political party in power should choose the control variable, the growth rate of moonlighting \( n^*(t) \), in such a manner that growth of moonlighting decreases over time.
  
  **Proof**
  
  Differentiating (3.5.21) with respect to time, we get
  
  \[ \frac{dn^*(t)}{dt} = -\frac{kb(\alpha \beta e^{B(t - t)})}{2a} < 0 \quad (3.5.22) \]
  
  This ensures that \( n^*(t) \) is a decreasing function of \( t \).

- **Proposition - 3.5.2**
  
  The \( n^*(t) \) values in the period \( t \in (0, T) \) must uniformly be positive. In times of next election the terminal moonlighting growth rate \( n^*(T) \) is a positive quantity such that 
  \[ 0 < n^*(T) < n^*(0). \]
  
  **Proof**
  
  Using \( t = 0 \) and \( t = T \) in (3.5.21), we get
  
  \[ n^*(0) = \frac{kb(r - \beta) + (\alpha \beta e^{BT})}{2aB} \quad (3.5.23) \]
  
  And
  
  \[ n^*(T) = \frac{kb(r - \beta + \alpha \beta)}{2aB} \quad (3.5.24) \]
  
  Using the fact that \( B = (r - \beta + \alpha \beta) \) in (3.5.24), we get
  
  \[ n^*(T) = \frac{kb}{2a} > 0 \quad (3.5.25) \]
  
  Equations (3.5.23) and (3.5.25) ensures that \( 0 < n^*(T) < n^*(0) \).
At $t = 0$ growth rate of moonlighting, is highest. It decreases over time since $n^*(t)$ is a decreasing function of $t$ and reaches at the minimum $\left(n^*(T)\right)$ in times of the next election period $t = T$. This tendency produces a cycle of $n^*(t)$ between two election periods. Cyclical paths of $n^*(t)$ over successive electoral periods produce a Political Business Cycle. In figure - 3.5.2, we have plotted such possibility of repetition over successive electoral periods.

![Figure – 3.5.2: Political Business Cycle of Moonlighting](image)

The incumbent party should follow the optimal path $n^*(t)$ for the interest of its re-election in year $t = T$. To maximize the vote winning power in the next election, the political party in power will take steps against moonlighting activities and get success in a certain extent, which is expected to satisfy the voters. In the period of next election, the political party will ask the voters to vote in favor of it by announcing its success of reducing growth rate of moonlighting activities to a certain extent and by promising to carry the process of reducing growth rate of moonlighting activities if it gets back to the power. The process will continue over successive electoral periods and optimal moonlighting growth path will follow a cyclical path over successive electoral periods as shown in Figure - 3.5.2. The validity of the model rests on the assumptions of ideal democracy.
Two points are to be noted from the model. First, to face the next election, the incumbent party may achieve maximum vote by reaching the point \( n^*(T) = 0 \). But reality is not reflected by this possibility. In such a case what will be the promises to the next election if the political party in power really keeps the so-called growth rate of moonlighting activities at a negligible level? Therefore the result that \( n^*(T) > 0 \) is close to the reality. Second, the functional form used in equation (3.5.7) assigns heavier weight to the growth rate of moonlighting than unemployment. This implies that the economy under study suffers massively from the shadow activities so that the citizens care more about the eradication of moonlighting. This consideration put some limit to the use of the proposed model to explain dynamics of moonlighting in the economies where shadow activities are not intimidating.

The Political Business Cycle of Moonlighting accentuates the fact that the rate of growth of moonlighting is externally (politically) determined. Political party in power wilfully regulates the moonlighting rate to ensure maximum vote in the next election. In addition to various causes of moonlighting, we would like to conclude this section by stating the fact that the rate of moonlighting is a political choice. The movement of moonlighting rate may be used by governmental authorities to fulfill political opportunism.

### 3.6. Political Business Cycle of Moonlighting in the Czech Republic

To test empirically the practical existence of the Political business Cycle of moonlighting, we choose a transitional economy like the Czech Republic. Transitional economies are more likely to suffer from moonlighting (Guariglia and Kim (2006)). The Czech shadow economy comprised of 17% of the total GDP in 2010, slightly below the European Union average and moonlighting is one of the major reasons behind shadow activities (Schneider (2010)). To combat shadow activities, the Czech Government have taken various actions including the reduction of bureaucracy, making tax submission process simple, broader adoption of electronic payment, controls and sanctions against illegal employment (moonlighting) etc. Among various sectors, shadow activities through moonlighting and informal work are highest in the construction industry (Schneider (2010)).
A multi-party parliamentary democratic system was introduced after the initiation of new sovereign state of the Czech Republic in 1993. In the Czech Republic, the President is the formal head of the state but enjoy limited power. The Prime Minister is the head of the Czech Government with ultimate supervisory power. To detect the existence of Political Business Cycle of Moonlighting in the Czech Republic, we exclude Presidential election because of the restricted power of President to regulate the economy. The Legislature in the state of Czech Republic is bicameral, the Chamber of Deputies and the Senate. Our empirical investigation of the PBC of moonlighting is restricted to the election of the Chamber of Deputies only because the Chamber of Deputies enjoys the maximum command and accountability to form a government (the regulatory authority of the economy).

**Fig. 3.6.1: Moonlighters as Proportion of Total Employment in the Czech Republic**

![Graph showing moonlighters as proportion of total employment in the Czech Republic from 1997 to 2011.](http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/)


To study the existence of political business cycle of moonlighting in the Czech Republic, we have to consider the severity of moonlighting in the country. As per the statistical report of the European Union, total number of moonlighters in the Czech Republic was 186.3 thousand in 1997. In 2011, the number of moonlighters has decreased to 103.8 thousand. The number of moonlighters as a percentage of the total employed persons decreases from nearly four percent in 1997 to two percent of the total employed persons in 2011 in the Czech Republic. Moonlighting
among Czech men decreases rapidly. The number of male moonlighters was 120 thousand in 1997, nearly 4.5 percent of the total employed persons. In 2011, the number of male moonlighters reduced to almost one third. But in percentage of employed people, moonlighting among men proved the existence to a moderately high level, 2.62 percent. In 1997, 66.2 thousand (3.11 percent of the total employment) Czech women were moonlighting. In 2011, the number of female moonlighters decreased to 43.3 thousand, 2.08 percent of the employed citizens. Figure 3.6.1 presents the moonlighting rates (as a proportion of total employment) over time in the Czech Republic. In chapter one, figure – 1.6.2, moonlighting rate as percent of total employment was presented. Those figures make certain the fact that moonlighting rate among male citizens are higher than moonlighting rate among female citizens. From the figure it is clear that the incidence of moonlighting was decreasing before 2007 but proves a slight increasing trend after 2007 in the Czech Republic.

3.6.1. Methodology

Most of the empirical literatures in the field of Political Business Cycle have considered following autoregressive model (with a lag order s, to be specified by the Schwarz Criterion) to justify political effects on time series;

\[ y_t = \theta_0 + \sum_{i=1}^{s} \theta_i y_{t-i} + \sum_{j=1}^{m} \mu_j X_{jt} + \lambda ELEC_t + \varepsilon_t \]  

(3.6.1)

where \( y_t \) is the time series, \( X_{jt} \) is the \( j^{th} \) explanatory variable, \( j=1,2,...,k \) and \( ELEC_t \) is a dummy variable equals with 1 for election period and 0 otherwise.

Our concern in this section is not to measure political effects on moonlighting in the Czech Republic, but to find out trends in moonlighting growth between two election periods. If the growth rate of moonlighting increases over time between two election periods, then it can never be concluded that external factors such as politics can play any role to explain moonlighting data generating process. If political business cycle exists at all to explain moonlighting, the growth of moonlighting should follow a declining tendency between two election periods since the presence of increasing tendency of moonlighting will restrain political party in power to use it as a success in the next election. Therefore, we follow a different methodology to study the fact that moonlighting data generating process may be interrupted by some political control.
To justify the effect of political decision to manipulate the growth rate of moonlighting in times of election in the Czech Republic, we consider time by means of spline functions. We take the first quarter of 1998 as the origin of moonlighting data and then split it into five regimes, depending on the election periods of the Chamber of Deputies. We have estimated time trends for those regimes in terms of spline functions. Our postulated model is to estimate the spline trend equation,

$$y_t = a_1 + \delta_1 w_{1t} + \delta_2 w_{2t} + \delta_3 w_{3t} + \delta_4 w_{4t} + \delta_5 w_{5t} + \varepsilon_t \tag{3.6.2}$$

where we define

$$w_{1t} = t$$  \hspace{1cm} \text{Regime 1}

$$w_{2t} = \begin{cases} 0 & \text{if } t \leq t_2 \\ t - t_2 & \text{if } t_2 < t \end{cases}$$  \hspace{1cm} \text{Regime 2}

$$w_{3t} = \begin{cases} 0 & \text{if } t \leq t_3 \\ t - t_3 & \text{if } t_3 < t \end{cases}$$  \hspace{1cm} \text{Regime 3}

$$w_{4t} = \begin{cases} 0 & \text{if } t \leq t_4 \\ t - t_4 & \text{if } t_4 < t \end{cases}$$  \hspace{1cm} \text{Regime 4}

$$w_{5t} = \begin{cases} 0 & \text{if } t \leq t_5 \\ t - t_5 & \text{if } t_5 < t \end{cases}$$  \hspace{1cm} \text{Regime 5}

such that $t_2, t_3, t_4, t_5$ are the knots of spline trend, the election quarters of the Chamber of Deputies in the Czech Republic in our analysis. If $\delta_i > 0 \ \forall i = 1,2,3,4,5$ we can conclude that no political manipulation affected $y_t$ to decrease in the regime $i$. This is indicative for non-existence of PBC. This supports Nordhaus’ (1975) view on PBC.

**3.6.2. Data Empirical Results and Discussion**

To estimate the econometric model (3.6.2), we use the time series quarterly data of the rate of second jobholding (moonlighting) from the first quarter of 1998 to the second quarter of 2011 in the Czech Republic. The data (from 1998Q1 to 2011Q2) are obtained from the official statistics portal of the European Union, [http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/](http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/).
Table - 3.6.1 shows the summary statistics. We have calculated the number of moonlighters as proportion of employed persons for total (TNOMAPEMP), male (MNOMAPEMP) and female (FNOMAPEMP). We carry out our empirical task to test the existence of PBC on the growth rates of TNOMAPEMP, MNOMAPEMP and FNOMAPEMP.

Table-3.6.1: Summary Statistics on Moonlighting in the Czech Republic during 1998 to 2011

<table>
<thead>
<tr>
<th></th>
<th>TOTAL</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Moonlighters ('000)</td>
<td>No. of Employed persons ('000)</td>
<td>No. of moonlighters as proportion of Employed Persons (TNOMAPEMP)</td>
</tr>
<tr>
<td>Mean</td>
<td>113.42</td>
<td>4738.59</td>
<td>0.02</td>
</tr>
<tr>
<td>Median</td>
<td>113.50</td>
<td>4733.95</td>
<td>0.02</td>
</tr>
<tr>
<td>Maximum</td>
<td>165.30</td>
<td>4961.80</td>
<td>0.03</td>
</tr>
<tr>
<td>Minimum</td>
<td>77.00</td>
<td>4596.20</td>
<td>0.02</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>20.20</td>
<td>102.01</td>
<td>0.00</td>
</tr>
<tr>
<td>C.V.</td>
<td>17.81</td>
<td>2.15</td>
<td>18.91</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.45</td>
<td>0.46</td>
<td>0.21</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.22</td>
<td>2.02</td>
<td>2.70</td>
</tr>
<tr>
<td>Observations</td>
<td>54</td>
<td>54</td>
<td>54</td>
</tr>
</tbody>
</table>


Table- 3.6.1. presents the summary statistics on moonlighting in the czech republic during 1998Q1 to 2011Q2. Some pointed that female moonlighters are more likely to moonlight than their male counterparts for immediate financial reasons (Kimmel and Powell (1999)), for constraints in the primary job (Averett (2001)), or to maintain immediate family responsibilities.
(Allen (1998)). But from Table – 1 it is clear that average number of male moonlighters (in ‘000) is not only higher than female moonlighters in the Czech Republic, but also average MNOMAPEMP is higher than FNOMAPEMP. C.V. of MNOMAPEMP is higher than FNOMAPEMP which implies male moonlighters are more likely to vary.

Table-3.6.2: Regression output of log (NOMAPEMP)

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>Diagnostic statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>Std.</td>
</tr>
<tr>
<td>REGIME1</td>
<td>-0.094</td>
</tr>
<tr>
<td>REGIME2</td>
<td>0.082</td>
</tr>
<tr>
<td>REGIME3</td>
<td>-0.001</td>
</tr>
<tr>
<td>REGIME4</td>
<td>0.005</td>
</tr>
<tr>
<td>REGIME5</td>
<td>0.075</td>
</tr>
<tr>
<td>C</td>
<td>-3.270</td>
</tr>
<tr>
<td>TIME</td>
<td>-0.010</td>
</tr>
<tr>
<td>C</td>
<td>-3.474</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MALE</th>
<th>Diagnostic statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>Std.</td>
</tr>
<tr>
<td>REGIME1</td>
<td>-0.103</td>
</tr>
<tr>
<td>REGIME2</td>
<td>0.089</td>
</tr>
<tr>
<td>REGIME3</td>
<td>-0.003</td>
</tr>
<tr>
<td>REGIME4</td>
<td>0.012</td>
</tr>
<tr>
<td>REGIME5</td>
<td>0.050</td>
</tr>
<tr>
<td>C</td>
<td>-3.106</td>
</tr>
<tr>
<td>TIME</td>
<td>-0.012</td>
</tr>
<tr>
<td>C</td>
<td>-3.328</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FEMALE</th>
<th>Diagnostic statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient</td>
<td>Std.</td>
</tr>
<tr>
<td>REGIME1</td>
<td>-0.080</td>
</tr>
<tr>
<td>REGIME2</td>
<td>0.071</td>
</tr>
<tr>
<td>REGIME3</td>
<td>0.002</td>
</tr>
<tr>
<td>REGIME4</td>
<td>-0.004</td>
</tr>
<tr>
<td>REGIME5</td>
<td>0.111</td>
</tr>
<tr>
<td>C</td>
<td>-3.526</td>
</tr>
<tr>
<td>TIME</td>
<td>-0.007</td>
</tr>
<tr>
<td>C</td>
<td>-3.695</td>
</tr>
</tbody>
</table>

We have estimated the econometric model (3.6.2) as well as trend growths of dependent variables \( y_t = \log(\text{TNOMAPEMP}) \), \( y_t = \log(\text{MNOMAPEMP}) \) and \( y_t = \log(\text{FNOMAPEMP}) \).

The regression results are presented in Table - 3.6.2. From this table it is clear that although \( R^2 \) is high, all coefficients (except for Regime 5) are insignificant at 10% level and therefore we cannot rely upon coefficients to conclude about the presence of PBC in the growth rates of TNOMAPEMP, MNOMAPEMP and FNOMAPEMP. The Durbin-Watson \( d \) statistic is very low, which confirms the presence of auto-correlation and indicates the possibility of non-stationarity. We obtain linear trend by estimating a simple trend equation \( y_t = \alpha + \delta t + \varepsilon_t \) which shows that the growth rates of TNOMAPEMP, MNOMAPEMP and FNOMAPEMP decreases over time but Durbin-Watson \( d \) statistic is very low which also indicates there may be unit root in the series.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Augmented Dickey-Fuller Test Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At Levels</td>
</tr>
<tr>
<td>TNOMAPEMP</td>
<td>-2.49803</td>
</tr>
<tr>
<td>MNOMAPEMP</td>
<td>-2.63735</td>
</tr>
<tr>
<td>FNOMAPEMP</td>
<td>-2.52619</td>
</tr>
</tbody>
</table>


To be confirm about the non stationarity of data, we perform unit root test. The results of the unit root test are presented in table – 3.6.3 which confirms from the ADF values of log (TNOMAPEMP), log (MNOMAPEMP and log (FNOMAPEMP) that these series are stationary not at levels but at first difference.

To avoid the problem of unit root, we consider the growth of growth rate of moonlighting, i.e.,

\[ y_t = \log \left( \frac{\text{TNOMAPEMP}}{\text{TNOMAPEMP}(1)} \right) \], \( y_t = \log \left( \frac{\text{MNOMAPEMP}}{\text{MNOMAPEMP}(1)} \right) \)

and

\[ y_t = \log \left( \frac{\text{FNOMAPEMP}}{\text{FNOMAPEMP}(1)} \right) \]

as different dependent variables to estimate (3.6.2) where TNOMAPEMP(1) is the first period lag of TNOMAPEMP, MNOMAPEMP(1) is
the first period lag of MNOMAPEMP and FNOMAPEMP(-1) is the first period lag of FNOMAPEMP. For the best fit of data, we estimate (3.6.2) without any constant term (\(a_t\)) for different regimes but to obtain linear trend, we estimated the same trend equation \(y_t = \alpha_1 + \delta_t t + \epsilon_t\).

Table 3.6.4: Regression output of log (NOMAPEMP/NOMAPEMP(-1))

<table>
<thead>
<tr>
<th></th>
<th>Coef</th>
<th>Std. Error</th>
<th>t-Stat</th>
<th>Prob.</th>
<th>Growth Rate</th>
<th>Diagnostic statistics</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(R^2) ((R^2))</td>
<td>F-Stat</td>
<td>DW stat</td>
<td></td>
</tr>
<tr>
<td>REGIME1</td>
<td>-0.020</td>
<td>0.009</td>
<td>-2.371</td>
<td>0.022</td>
<td>-2.00</td>
<td>0.26 (0.20)</td>
<td>4.237</td>
<td>1.601</td>
<td></td>
</tr>
<tr>
<td>REGIME2</td>
<td>0.023</td>
<td>0.010</td>
<td>2.358</td>
<td>0.023</td>
<td>0.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REGIME3</td>
<td>-0.006</td>
<td>0.003</td>
<td>-2.488</td>
<td>0.016</td>
<td>-0.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REGIME4</td>
<td>0.009</td>
<td>0.003</td>
<td>3.511</td>
<td>0.001</td>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REGIME5</td>
<td>-0.023</td>
<td>0.010</td>
<td>-2.366</td>
<td>0.022</td>
<td>-1.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>0.001</td>
<td>0.000</td>
<td>1.835</td>
<td>0.072</td>
<td>0.06</td>
<td>0.06 (0.04)</td>
<td>3.37</td>
<td>1.257</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>-0.028</td>
<td>0.012</td>
<td>-2.304</td>
<td>0.025</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MALE

| REGIME1        | -0.022| 0.009      | -2.477 | 0.017 | -2.20       | 0.28 (0.22)            | 4.619 | 2.053  |        |
| REGIME2        | 0.026 | 0.010      | 2.448  | 0.018 | 0.33        |                       |       |        |        |
| REGIME3        | -0.007| 0.003      | -2.401 | 0.020 | -0.32       |                       |       |        |        |
| REGIME4        | 0.009 | 0.003      | 3.397  | 0.001 | 0.58        |                       |       |        |        |
| REGIME5        | -0.035| 0.010      | -3.416 | 0.001 | -2.88       |                       |       |        |        |
| TIME           | 0.001 | 0.000      | 1.415  | 0.163 | 0.04        | 0.04 (0.02)            | 2.003 | 1.569  |        |
| C              | -0.028| 0.013      | -2.122 | 0.039 |             |                       |       |        |        |

FEMALE

| REGIME1        | -0.017| 0.015      | -1.092 | 0.280 | -1.64       | 0.12 (0.04)            | 1.56  | 1.60   |        |
| REGIME2        | 0.019 | 0.018      | 1.100  | 0.277 | 0.28        |                       |       |        |        |
| REGIME3        | -0.006| 0.005      | -1.342 | 0.186 | -0.33       |                       |       |        |        |
| REGIME4        | 0.009 | 0.004      | 1.936  | 0.059 | 0.53        |                       |       |        |        |
| REGIME5        | -0.006| 0.017      | -0.346 | 0.731 | -0.06       |                       |       |        |        |
| TIME           | 0.001 | 0.001      | 1.376  | 0.175 | 0.04        | 0.04 (0.02)            | 1.89  | 1.46   |        |
| C              | -0.028| 0.020      | -1.390 | 0.170 |             |                       |       |        |        |

The regression result is presented in table – 3.6.4. The table – 3.6.4 confirms that all the coefficients are significant; moonlighting growth rate decreases over time in the regimes 1, 3 and 5, and increases in regimes 2 and 4 for total, male and female. For all moonlighters, moonlighting growth rate decreases at the rate 2.00, 0.32 and 1.73 in the regimes 1, 3 and 5 respectively. Overall moonlighting growth rate increases at the rate 0.32 and 0.56 in regimes 2 and 4 respectively. Similarly, male (female) moonlighting growth rate decreases at the rate 2.20 (1.64), 0.32 (0.33), 2.88 (0.06) in the regimes 1, 3 and 5 respectively. Male (female) moonlighting growth rate increases at the rate 0.33 (0.28) and 0.58 (0.53) in regimes 2 and 4 respectively. No experience of decrease in moonlighting growth rate has been found in regimes 2 and 4. That means existence of PBC is not proved for regimes 2 and 4. In other words manipulation of moonlighting growth by the incumbent party in the Czech Republic to influence the voters for the urge of being re-elected in the next election is not the reality in the regimes 2 and 4. PBC is absent for the periods of 1998Q2 to 2002Q2 and 2006 Q2 to 2010Q2.

To analyze the existence of any role of politics to explain the dynamics of moonlighting in the Czech Republic, we carried out an empirical task to find out trends in moonlighting growth by estimating time trends for regimes between two election periods of the Chamber of Deputies in terms of spline functions. According to our empirical analysis, moonlighting growth rate decreases over time for the regimes 1, 3 and 5 for both male and female but increases over time for regimes 2 and 4. That means PBC of moonlighting may present in the regimes 1, 3 and 5, i.e., there may some political influence to lower moonlighting growth in the Czech Republic for the periods before 1998Q2, 2002Q2 to 2006Q2 and 2010Q2 to 2011Q2. But as moonlighting grows in the regimes 2 and 4, the existence of PBC is absent for the periods of 1998Q2 to 2002Q2 and 2006 Q2 to 2010Q2. The global (absolute) existence of PBC of moonlighting in the Czech Republic is, therefore, under question.

3.7. Conclusion

In this chapter we have analyzed the causes of moonlighting. Several researchers have identified various factors affecting moonlighting decision of workers. To add a bit into the list of influencing factors on moonlighting, we have carried out three different assignments in this chapter.
First, we have tried to find out empirically the main determinants of moonlighting in the Hasnabad Block of the state of West Bengal. In that empirical assignment after formulating and estimating a logit model we concluded that the hours worked in primary job (HWPJ) is an important determinant of moonlighting decision of the heads of households residing in Hasnabad Block of West Bengal. This entails the validation of the ‘hours constraint’ as one of the prime motivating force of moonlighting decision by the heads of families in Hasnabad Block. Since the coefficients of HWPJ are negative and significant in both models, increase in HWPJ will surely reduce the probability of moonlighting. Therefore, those heads of families are constrained in their primary job so that any increase in HWPJ affect negatively to the moonlighting decision. Secondly, the decision to moonlight is negatively affected by income from primary job. As increased income from primary job lowers the probability of moonlighting (log odds of moonlighting), it may be concluded that moonlighters in Hasnabad Block are income constrained. They could not earn as much income as they want to maintain their livelihood and therefore opted to moonlight. We can conclude that heads of households of Hasnabad moonlight primarily due to financial reasons. Our analysis further confirmed that financially included persons (bank account holders) are more likely to be a moonlighter. Heads of Hindu families are less likely to moonlight than others. Occupational status and the level of education are not so important to determine moonlighting probability of family heads in Hasnabad.

Second, we have formulated a political business cycle model of moonlighting assuming the political party in power has some role to regulate moonlighting activities. The leading party will act to take the policy of decreasing the growth rate of moonlighting activities imminent to the election, to maximize vote. The time series of moonlighting will follow a path specified by politics will generate a political business cycle. To maximize the vote winning power in the next election, the political party in power will take steps against moonlighting activities and get success in a certain extent, which is expected to satisfy the voters. In the period of next election, the political party will ask the voters to vote in favor of it by announcing its success of reducing growth rate of moonlighting activities to a certain extent and by promising to carry the process of reducing growth rate of moonlighting activities if it gets back to the power. The process will
continue over successive electoral periods and optimal moonlighting growth path will follow a
cyclical path over successive electoral periods.

Third, we have investigated empirically any practical existence of the Political business Cycle of
moonlighting in the Czech Republic. Using time series data and applying the method of
estimating spline function, we concluded that the PBC of moonlighting may present (there may
some political influence to lower moonlighting growth) in the Czech Republic for the periods
before 1998Q2, 2002Q2 to 2006Q2 and 2010Q2 to 2011Q2. But the existence of PBC is surely
absent for the periods of 1998Q2 to 2002Q2 and 2006 Q2 to 2010Q2. Therefore we cannot prove
a global (absolute) existence of PBC of moonlighting in the Czech Republic.

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NOTES

i They derive a rigorous microeconomic theory of moonlighting which is not repeated here.

ii If an unconstrained worker faces \( w_2 < w_1 \) he/she would like to supply more hours on his/her higher paying
primary job and generally dislike to be a moonlighter. If an unconstrained worker with \( w_2 < w_1 \) decides to
moonlight due to some emotional attachment to the secondary job, it is not possible to picture that case in the static
framework.

iii A constrained moonlighter always face \( w_2 < w_1 \).

iv This reflects patriarchal social system in rural Bengal.

v VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient
between variable j and the other independent variables

on matters of interest to the arts community commissioned by the Research Division of the National Endowment of
the Arts.

vii Jill Rubery (1989) “Precarious forms of work in the United Kingdom” in Precarious jobs in labour market
regulation: The growth of atypical employment in Western Europe Edited by Gerry and Janine Rodgers

of the Nordhaus Political Business Cycle using Phillips relation between inflation and unemployment. We have
followed the formulation by using inverse relation between moonlighting growth rate and unemployment.